Republic of Cuba

FY2024 Ex-Post Evaluation Report of Japanese Grant Aid Project

"Project for Improvement of Medical Equipment for Strengthening Medical Services at Major Hospitals"

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

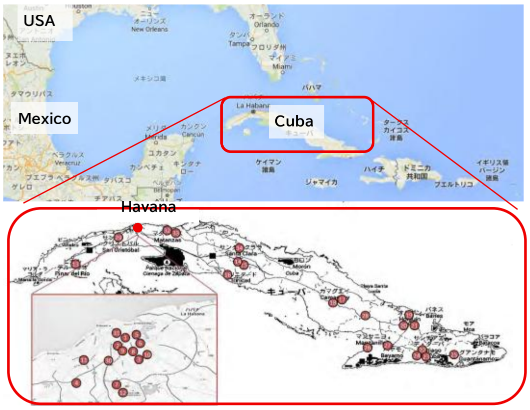
0. Summary

The "Project for Improvement of Medical Equipment for Strengthening Medical Services at Major Hospitals" (hereinafter referred to as "the Project") was implemented with the objective of enhancing cancer diagnosis and minimally invasive medicines by equipping major medical facilities in the Republic of Cuba (hereinafter referred to as "Cuba") with the necessary equipment for digitizing medical imaging diagnostic systems, pathology testing, and minimally invasive medicine[1], thereby contributing to the expansion and improvement of healthcare services and improvement of their quality in the country. The Project was found to be highly consistent with Cuba's development plans and needs at both the planning and ex-post evaluation stages, as well as with Japan's development cooperation policy at the planning stage. Concrete synergies with other JICA projects were also observed. Therefore, its relevance and coherence are high. The project outputs were generally delivered as planned and within budget; however, the project period significantly exceeded the plan. Therefore, efficiency of the Project is moderately low. The equipment provided by the Project has been effectively utilized, resulting in faster and more accurate medical diagnosis and treatment. The Project's objectives were fully achieved in the field of X-ray diagnostic imaging (24 hospitals), mostly achieved in the field of pathology testing (14 hospitals), and partially achieved in the field of minimally invasive medicine (6 hospitals). These efforts have had a significant impact on the diagnosis and treatment of cancer and other diseases. Therefore, effectiveness and impacts of the Project are high. In terms of sustainability, there are no major issues from policy and system, environmental and social, or preventive measures to risks aspects. However, due to the country's recent severe economic situation, there has been a major outflow of human resources from the public sector. Consequently, a shortage of personnel in terms of organizational structure and a loss of trained human resources in terms of technical capacity have become issues. On the financial side, financial constraints make it difficult to procure replacement parts in a timely manner. Consequently, it is difficult to operate and maintain some equipment. Therefore, sustainability of the project effects is moderately low.

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

[1] Minimally invasive medicine refers to a medical approach that aims to reduce the physical burden (invasiveness) on the body as much as possible.

1. Project Description



Project Location
(Source: preparatory survey report)

Digital X-ray diagnostic device
(mammography)[2]

1.1 Background

Cuba's healthcare system is entirely operated by the state, with no private medical services. All citizens are entitled to free medical care, and emphasis is placed on preventive medicine and a community-based family doctor system.

As of 2014, cancer was the leading cause of death in Cuba. Since 1987, the Cuban government has implemented the "National Strategy for Cancer Control," aiming to reduce the incidence and mortality rates of cancer, improve patient survival rates, and enhance the quality of life through prevention, early detection, diagnosis and treatment, and palliative care. In 2014, Cuba also launched the "National Policy for the Digitalization of Radiological Imaging," initiating a national effort to digitize radiological diagnostics.

However, due to chronic foreign currency shortages and severe financial constraints, Cuban medical institutions have long faced persistent shortages and deterioration of medical equipment, making timely and appropriate diagnosis difficult. The situation was particularly dire in eastern regions with lower economic standards, forcing patients to seek referrals or travel to other regions for diagnosis and treatment.

In response to these circumstances, a grant agreement for the Project was signed in September 2016 to provide equipment necessary for digitizing medical imaging diagnostic systems, pathology testing, and minimally invasive medicine across 34 major medical institutions nationwide in Cuba.

1.2 Project Outline

The Project enhances cancer diagnosis and minimally invasive medicines by equipping major medical facilities in Cuba with the necessary equipment for digitizing medical imaging diagnostic systems, pathology testing, and minimally invasive medicine, thereby contributing to the

2 All photographs in this report were taken by the external evaluator during the site visit, unless otherwise noted.

expansion and improvement of healthcare services and improvement of their quality in the country.

Grant Limit / Actual Grant Amount	1,273 million yen / 1,252million yen
Exchange of Notes Date / Grant Agreement Date	September 2016 / September 2016
Executing Agencies	Department of Medical and Social Assistance, Ministry of Public Health (currently Medical Technologies, Consumables, and Clinical Furniture Bureau), Health Directorate of the 12 target provinces
Project Completion	December 2019
Target Area	34 hospitals in the provinces of Havana, Pinar del Rio, Artemisa, Matanzas, Las Tunas, Holguín, Granma, Santiago de Cuba, Guantánamo, Villa Clara, Cienfuegos and Camaguey
Main Contractor(s)	Marubeni Protechs Corporation
Main Consultant(s)	ITEC, Estrella Inc. (JV)
Procurement Agency	none
Basic Design / Preparatory Survey	August 2016
Related Projects	"Project for Capacity Building of Medical Equipment Maintenance and Early Diagnosis of Cancer" (July 2017 – January 2021), "Project to Promote Hospital Digitalization in Image Diagnosis" (April 2022 – April 2025)

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, 2024 – January, 2026

Duration of the Field Study: February 18 – March 15, 2025
June 7 – 12, 2025

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

3.1 Relevance/Coherence (Rating: ③[4])

3.1.1 Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Cuba

The "Guidelines of the Economic and Social Policy" adopted at the 6th Congress of the Communist Party of Cuba in 2011 identified, as priority issues, the reorganization of the healthcare system according to demand and the provision of high-quality services to patients.

At the 8th Congress of the Communist Party of Cuba in 2021, the provision of free medical services to all citizens was reaffirmed as a top national priority. The importance of education and training for healthcare professionals was also emphasized. In 2023, a new "Public Health Law" was enacted to adapt the Cuban healthcare system to modern challenges and ensure comprehensive services for all citizens. Furthermore, the revised "National Strategy for Cancer Control" (2020) emphasized the need to strengthen prevention and early diagnosis activities at the primary care level.

Given these developments, the Project was consistent with Cuba's development plans both at the time of planning and at the time of the ex-post evaluation.

3.1.1.2 Consistency with the Development Needs of Cuba

As described in "1.1 Background," the need for medical equipment in major hospitals across the country was extremely high at the time of planning. Although diagnostic imaging (CT, MRI), endoscopy, and pathology equipment was installed in Cuba's secondary and tertiary care facilities 15 to 20 years ago, all were aging and many were not functioning. While some equipment for X-ray diagnostics was procured through UNDP after the Project, procurement of other types of equipment had not progressed, and the need for further equipment remained high at the time of the ex-post evaluation. Under Cuba's national health system, medical equipment is prioritized for repair or replacement according to national health priorities, with particular focus on cancer and other critical diseases. The equipment provided through the Project continued to be fully utilized at the time of the ex-post evaluation, demonstrating that the needs addressed by the Project remained relevant.

Therefore, the Project was well aligned with the country's development needs at both the planning and ex-post evaluation stages.

3.1.1.3 Appropriateness of the Project Plan and Approach

According to JICA, the formation of the Project and other cooperation initiatives with Cuba at that time were supported by the normalization of diplomatic relations with the United States

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

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

(July 2015) and the easing of economic sanctions under the Obama administration. However, subsequent shifts in U.S. policy and the COVID-19 pandemic worsened Cuba's economic situation significantly, leading to human resource outflows and constraints on government budgets, which in turn undermined the Project's sustainability.

During the planning stage, it was noted that "for the Project to be implemented smoothly and to achieve sustainable outcomes, it is important that the current political and economic situation does not deteriorate significantly in the future." Given the significant impact of U.S. policies on Cuba's economy, this concern was valid. However, this precondition was not met. The prolonged economic turmoil and human resource outflow in recent years are beyond what could reasonably have been predicted at the time.[5]

On the other hand, in terms of sustainability measures, the Project included the provision of spare parts and consumables, training through soft components for the use of advanced equipment, and maintenance contracts for some high-value equipment. These actions show that JICA took appropriate measures to ensure sustainability to the extent possible.

Thus, while the Project could not fully respond to significant changes in external conditions, the planning and approach themselves cannot be considered flawed.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

Japan's Country Assistance Policy for Cuba at the time of planning (April 2014) emphasized support for "sustainable social and economic development," including assistance in the health and medical sectors. Therefore, the Project was consistent with Japan's development cooperation policy.

3.1.2.2 Internal Coherence

JICA had implemented two technical cooperation projects in the Cuban health sector that were related to the Project. In particular, concrete synergies were confirmed with the "Project to Promote Hospital Digitalization of Diagnostic Imaging" (2022–2025). Notably, these synergies

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[5] Due to the tightening of economic sanctions by the first Trump administration and the stagnation of the tourism industry caused by the COVID-19 pandemic, Cuba is facing a severe socio-economic crisis. Amid ongoing shortages of foreign currency and goods, rising prices, and unstable electricity supply, it is estimated that approximately 1.12 million people – about 10% of the population – emigrated from the country between the end of 2021 and the end of 2023. The value of the local currency has plummeted, and the real value of wages has significantly declined. Many healthcare workers, including doctors, are choosing to change careers or emigrate abroad due to economic hardship, and in 2023, the number of doctors reportedly decreased by 13,000. The shortage of medical personnel is particularly serious in the capital region.

(Sources: Access on January 23, 2026)

https://havanatimes.org/features/the-sad-state-of-health-care-in-cuba-for-2024/?utm_source=chatgpt.com

https://www.weareceda.org/en/us-cuba-news-brief/cubas-largest-emigration-in-history-july-25-2024?utm_source=chatgpt.com

https://en.cibercuba.com/noticias/2024-12-24-u1-e199894-s27061-nid294380-cuba-pierde-13300-medicos-2023-duro-golpe-al-sistema?utm_source=chatgpt.com#google_vignette were not anticipated at the planning stage of the Project.

Project for Capacity Building of Medical Equipment Maintenance and Early Diagnosis of Cancer (July 2017 – January 2021)

- This project was formulated concurrently with the Project. One of its planned output was "strengthened capacity of doctors to conduct screening tests and diagnoses for cancer." Training in Japan at the National Center for Global Health and Medicine in Tokyo and the dispatch of medical experts were conducted for three hospitals that received equipment under the Project. While it is considered that the training enhanced doctors' diagnostic capabilities and promoted effective use of the equipment of the Project where installation was completed in time, no specific synergies could be confirmed.

Project to Promote Hospital Digitalization in Image Diagnosis (April 2022 – April 2025)

- Hospital networks were developed by the technical cooperation project in five hospitals where digital X-ray equipment had been installed through the Project, and a national plan and guidelines for hospital digitalization were formulated.
- The digitization of X-ray diagnostics under the Project significantly improved the accuracy and efficiency of diagnostics. Furthermore, the ability to share and store images within hospital networks has led to even greater improvements in diagnostic precision and efficiency (see "3.3 Effectiveness and Impacts").
- The Project provided servers and connection cables for image diagnostics, which were used to establish partial networks in the hospitals. These were utilized for developing the pilot hospital networks under the technical cooperation project.
- Additionally, spare parts for the digital X-ray imaging systems provided by the Project were supplied under the technical cooperation project, enabling continuous use of the equipment.

3.1.2.3 External Coherence

In the Fiscal Year 2020 Grant Aid for Economic and Social Development Programme implemented by Japan's Ministry of Foreign Affairs, a total of 13 mobile X-ray imaging systems, 44 portable ultrasound diagnostic devices, and 1,000 suction machines were procured. Separately, the United Nations Development Programme (UNDP), in cooperation with the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), provided 251 digital X-ray imaging systems to medical institutions throughout the country. These devices were distributed to 197 polyclinics (primary care institutions) and 23 hospitals, contributing to enhanced diagnostic capacity and improved preparedness for future pandemics and emergency situations.

Some of the medical institutions that received equipment through these aid programs overlapped with those supported under the Project. In such cases, the equipment provided by the various donors has been used together in clinical settings. This complementary use has contributed to strengthening cancer diagnosis and improving both the reach and quality of medical services at the beneficiary hospitals. Therefore, it can be concluded that the Project has generated synergies with other donor-funded initiatives.

Thus, the Project is consistent with Cuba's policies and needs both at the time of planning and at the time of ex-post evaluation, and there were no major issues with the project design or approach. In addition, although not anticipated during the planning stage, the Project generated concrete synergies with the technical cooperation "Project to Promote Hospital Digitalization in Image Diagnosis." Synergies with other donor-funded projects were also observed.

Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

In the Project, it was planned to procure medical equipment for the fields of diagnostic imaging, pathology testing, and minimally invasive medicine at 34 hospitals nationwide. In addition, training for maintenance management of the medical equipment (soft components) was planned, as well as maintenance contracts for some of the equipment. As shown in Table 1, outputs were generally achieved according to plan. An overview of the equipment for each field is provided in Table 2.

Table 1. Planned and Actual Outputs

Planned Outputs	Actual Outputs
Diagnostic imaging (24 hospitals) Pathology testing (14 hospitals) Minimally invasive medicine (6 hospitals)	Mostly as planned
Soft component (training): repair and inspection, maintenance records, inventory control, parts and tools procurement management	Mostly as planned
Maintenance contracts	As planned

Source: Materials provided by JICA and executing agency
Note: Replacement parts for some equipment were also procured.

Table 2. Overview of Medical Equipment Procured under the Project

<Diagnostic Imaging>

Before the Project, each hospital used an analog X-ray diagnostic system that employed film. This system involved inserting X-ray film and intensifying screens into a “cassette,” which was placed below or beside the patient’s examination site during imaging. The exposed film was then processed in a darkroom through development, fixing, washing, and drying. Therefore, a darkroom was always installed adjacent to the X-ray room. Under the Project, digital X-ray imaging systems using FPD and CR methods were procured for 24 hospitals.

- FPD (Flat Panel Detector) is a panel of similar size to a cassette, used by inserting it into the analog X-ray diagnostic system. The images are transmitted to a PC via cable or Wi-Fi and can be viewed almost simultaneously with imaging. Existing analog X-ray diagnostic devices can be utilized as they are. One system was provided for each of 15 hospitals.
- New digital X-ray diagnostic devices incorporating FPD were procured: one general X-ray diagnostic device each for 6 hospitals and one mammography device each for 3 hospitals.
- CR (Computed Radiography) uses a special cassette containing an imaging plate that replaces film; the images are recorded electronically and can be transferred to a PC by inserting the cassette into a CR reader. Like FPD, it can utilize existing analog X-ray diagnostic devices. After each imaging, the cassette is removed from the X-ray device and read by the CR reader over 20 to 30 seconds. One general X-ray CR system was procured for each of 19 hospitals, and one mammography CR system for each of 5 hospitals.
- High-resolution evaluation stations for assessing digital images, data servers for storing and sharing images, and network equipment were procured for each hospital.

<Pathology Testing>

Pathological examination is a test that observes organs, tissues, and cells under a microscope to investigate the presence and progression of diseases, especially cancer. Samples are obtained through biopsies or surgical removal of organs. Generally, pathology tests are always performed in cancer surgeries to confirm the diagnosis, determine the stage, and assess the necessity of additional treatments such as chemotherapy or radiation therapy. Under the Project, a full set of necessary pathology equipment was procured for 14 hospitals. These hospitals had been using very old equipment (over 20 years old) for pathology tests. The same types and quantities of equipment were procured for all 14 hospitals. The main equipment includes:

- Tissue processor: Automatically performs pretreatment of formalin-fixed tissues.
- Automated embedding system: Solidifies the pretreated tissues in paraffin to form blocks.
- Microtome: Cuts paraffin blocks into thin slices of 4 to 5 micron thick.
- Automated staining device: Stains tissues to make cellular structures easier to observe.
- Optical microscopes: Used to observe stained tissue samples for diagnosis. In addition to six standard binocular microscopes, one polarized microscope, one trinocular microscope (capable of attaching a camera), and one pentaocular microscope (for educational use)

were procured.

- Cryostat: Freezes and sections tissues for intraoperative biopsy. (Since rapid results are required in intraoperative biopsy, formalin fixation and paraffin embedding are not performed.)

<Minimally Invasive Medicine>

Under the Project, three types of endoscopic systems (gastrointestinal endoscope system, laparoscopic system, and bronchoscope system) were procured for six hospitals.

- Gastrointestinal endoscope system: Used to detect lesions inside the gastrointestinal tract and, when necessary, to collect biopsy tissue samples using biopsy forceps.[6] There are two video scopes: one for the upper GI tract and one for the lower GI tract.
- Laparoscopic system: An endoscopic system for observing and performing surgery inside the abdominal cavity, used for minimally invasive surgeries involving only small incisions without open abdominal surgery.
- Bronchoscope: An endoscope for observing the inside of the trachea and bronchi.
- All systems consist of video scopes, monitors, and video processors.

Photo 1. Digital X-ray diagnostic device (general X-ray)

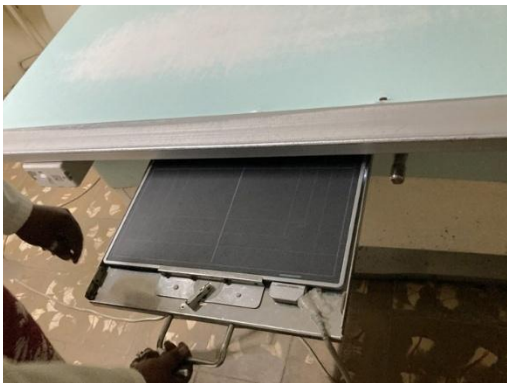

Photo 2. FPD

Photo 3. CR reader reading images from cassette

Photo 4. Reading room

[6] Forceps are tools that are inserted into the videoscope to perform biopsies during an examination.

Photo 5. Tissue processor

Photo 6. Microscopic diagnosis

Photo 7. Endoscope for digestive tubes

Photo 8. CNE's Repair workshop for endoscopes

The original plan included three analog mammography units; however, in line with the Ministry of Public Health's policy to advance the digitalization of diagnostic imaging, these were changed to digital units. The digitalization of X-ray diagnostic imaging offers significant advantages, making this a proper modification. During inland transportation of equipment carried out under Cuban responsibility, two PCs and two NAS (network-attached storage) units were lost, and substitute equipment owned by the Ministry of Public Health was provided.[7]

According to the Ministry of Public Health, the executing agency of the Project, the target hospitals were all important core hospitals but faced serious equipment shortages, and their selection was appropriate. The technical level of the procured equipment was sufficiently high, and the planning was appropriate to meet not only clinical but also educational needs.[8] The specifications and quality of the procured equipment were adequately high. Users of the equipment at each hospital highly evaluated the performance of the Project's equipment. However, it was pointed out that some pathology department equipment consumes more consumables (such as staining reagents and solvents) than existing equipment, making them more vulnerable to consumable shortages.

[7] In ordinary grant aid projects, contractors take consistent responsibility up to installation; however, since there are no domestic private transportation companies in Cuba, customs clearance and inland transportation were the responsibility of the Cuban side.

[8] In Cuba, systematic human resource development is conducted at all medical institutions.

As part of the equipment procurement contract, approximately one month of training was conducted in Japan for technicians of the National Medical Equipment Center (hereinafter, "CNE"), the maintenance institution, by three Japanese medical equipment manufacturers. Separately, instruction by Japanese engineers on the soft component was limited to Havana and central-west Cuba due to the COVID-19 pandemic; in the eastern region, cascade training was conducted by CNE technicians and equipment managers who had received the training.

Under the accompanying maintenance contracts, repeated dispatches of manufacturer engineers took place over three fiscal years for digital X-ray diagnostic devices and endoscopes, during which equipment inspections and guidance for maintenance technicians were provided. Although the first dispatch was delayed due to the COVID-19 pandemic, three dispatches were carried out as contracted. Additionally, CNE technicians and equipment managers were invited to Japan for about one week for maintenance training by manufacturers. Furthermore, replacement parts for some equipment were supplied.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned total cost of the Project was 1,491 million yen, of which the planned cost of the Japanese side was 1,273 million yen. The actual cost of the Japanese side was 1,249 million yen (98% of the plan), remaining within the plan. No information was obtained on the actual cost of the Cuban side.

3.2.2.2 Project Period

The Project was planned to be implemented over a total of 13 months from the signing of the grant agreement in July 2016 until the start of equipment use in July 2017. In reality, the grant agreement was signed in September 2016, and the final equipment was put in use in December 2019. The project period was 40 months (308% of the planned period), significantly exceeding the plan.

Due to restrictions imposed by the U.S. economic sanctions on exports to Cuba, the equipment for the Project was procured under two separate contracts, dividing equipment that could potentially violate the sanctions from other equipment. In relation to this, some equipment had to be procured from Europe. According to the Ministry of Public Health and the Project consultants, the main reasons for the significant delay in implementation are as follows:

- The timing of the bidding was delayed due to a delay in completing the necessary banking procedures on the Cuban side.
- Due to U.S. export regulations, some equipment required export licenses from the U.S. Department of Commerce and the U.S. Department of the Treasury. Obtaining these licenses

took time, and in some cases licenses were not granted, requiring procurement of alternative models. These factors significantly delayed shipment schedules.

- During equipment installation, issues were discovered with the UPS (uninterruptible power supply) and X-ray tube, and a digital general-purpose X-ray diagnostic system was damaged during transportation, necessitating re-procurement.
- One digital X-ray imaging diagnostic system went missing during inland transportation, and considerable time was required for its search.

According to JICA and the consultants, it was recognized at the planning stage that there would be various restrictions on equipment procurement for Cuba due to U.S. economic sanctions. However, since the Project was the first grant aid cooperation with Cuba, JICA had no concrete experience, and it was difficult to estimate how long the process would take until the Project actually began.

In summary, the Project generally achieved the planned outputs and the project cost remained within the plan; however, the project period significantly exceeded the plan.

Therefore, efficiency of the Project is moderately low.

3.3 Effectiveness and Impacts[9] (Rating: ③)

3.3.1 Effectiveness

In the Project, the numbers of general X-ray images taken, mammography images taken, upper and lower endoscopic examinations, laparoscopic surgeries, and biopsy tests at all target hospitals have been set as performance indicators, with baseline values (average results from 2013 to 2015) and target values (for 2020) established for each indicator. However, the Preparatory survey report does not explicitly state the basis for setting these target values, and interviews with the consultants who conducted the preparatory survey did not clarify this either.

To obtain actual values for these indicators, this ex-post evaluation attempted to collect information on the indicator results from each hospital through questionnaire survey and on-site / telephone interviews.[10] However, due to the large number of target hospitals and their remote locations, complete data collection and verification were difficult.

On the other hand, according to interviews with the Ministry of Public Health and each hospital, the Project yielded a wide range of important qualitative effects that cannot be captured by the above indicators. Based on the above, this ex-post evaluation treats the indicator results

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

[10] Responses to the questionnaire were obtained from 34 target hospitals through the Ministry of Public Health, 22 hospitals were visited, and telephone interviews were conducted with 12 hospitals.

only as reference information, and the Project's effectiveness is evaluated in a comprehensive manner by considering equipment utilization status and various qualitative effects. The following sections summarize the equipment overview, utilization status, and project effects by field.

3.3.1.1 X-ray Diagnostic Imaging

(1) Operation and Utilization of the Equipment

The operational and utilization status of the main X-ray diagnostic imaging equipment of the Project is as follows. Although some equipment has broken down after more than five years since installation, all functioning equipment is being sufficiently utilized.

Table 3. Functional and Utilization Status of Equipment (X-ray Diagnostic Imaging)

	Qty.	Function Percentage of equipment in "good" or "normal" functional condition*	Utilization Percentage of equipment in "very high" or "high" level of utilization**
FPD System	15	53%	73%
CR System (general X-ray)	19	89%	89%
CR System (mammography)	5	100%	100%
General X-ray equipment (with FPD)	6	83%	100%
Mammography equipment (with FPD)	3	100%	100%

Source: Questionnaire survey and interview results from the target hospitals

Notes: * Refers to the functional condition of equipment procured under the Project (excluding equipment provided through technical cooperation). Responses were selected from four categories - "Good," "Normal," "Partially functional," and "Non-functional."

** Includes cases where the equipment is used together with that provided through technical cooperation. Responses were selected from four categories - "Very high," "High," "Low," and "Very low."

Some of the target hospitals have CT and MRI devices installed; however, many of these are not operational due to aging deterioration, so X-ray imaging devices play an important role in diagnostic imaging. In particular, general X-ray diagnostic equipment installed in high-patient-volume departments (such as outpatient departments of pediatric hospitals and emergency outpatient departments) are heavily used. Many of the failures in the Project's FPD and CR systems are considered to have occurred due to this heavy use.

The FPDs have experienced damage due to drops during movement, cable breakage, and software malfunctions. Battery and charger degradation has also progressed. So far, the FPDs at 7 out of 15 hospitals have become unusable; however, under the technical cooperation: "Project to Promote of Hospital Digitalization in Image Diagnosis," one FPD, and several batteries and chargers were provided to each of 10 hospitals. These are connected to the Project's FPD systems (including PCs) and are being utilized.

Because the dedicated cassettes for CR are inserted into the CR reader after each imaging, the plastic latch mechanism deteriorates even with normal repeated use. They are also sometimes dropped accidentally, and the number of usable dedicated cassettes is gradually decreasing. The imaging plates are also deteriorating. Under JICA technical cooperation, new dedicated cassettes and imaging plates were provided to 10 hospitals and are being used for imaging with the Project's CR readers.

The FPDs and CR cassettes have shapes similar to conventional cassettes, and immediately after installation, damage occurred due to rough handling, as their nature as precision equipment was not fully understood. However, hospitals that lost their FPDs and later received new ones through technical cooperation became more careful based on their experience of damaging valuable equipment, paying close attention to minimizing movement and handling them with care.

Display stations (for diagnosis and image reading) and multiple evaluation stations (for reference and explanation) were procured for each hospital; however, some of these have become unusable due to aging deterioration and voltage fluctuations. In some target hospitals, available equipment is used in combination with other devices (such as PCs). Although UPS units to protect equipment from voltage fluctuations were also procured, severe voltage fluctuations and frequent power outages have caused rapid battery deterioration, rendering most UPS units almost unusable. Some hospitals use UPS units outside of the Project that are still functional.

(2) Quantitative Effects (Indicators: reference information)

At the planning stage, the number of general X-ray and mammography images taken were set as indicators. Based on the number of images taken at each hospital before the Project and projected population growth, predicted numbers of images to be taken were calculated. Furthermore, final target values were established assuming that improved examination efficiency would allow meeting potential demand. While part of the calculation process for the predicted numbers of images to be taken was confirmed, the basis for calculating the target values could not be verified.[11]

The general X-ray and mammography equipment procured under the Project are being utilized at all 24 target hospitals as long as they are operational. Information on the number of general X-ray images taken in 2024 was obtained from 20 of the 24 hospitals, and the number of mammography images taken from 7 of the 8 hospitals. Comparisons with baseline values at the planning stage are as follows.

[11] In the preparatory survey, it was stated that "the target value was set in consideration of the anticipated improvements due to the installation of medical equipment, such as reduced breakdown frequency, greater operational efficiency, and faster procedures." Based on this, the target was set assuming that there was a latent demand for X-ray imaging equivalent to approximately 40% more than the actual number of images taken. However, according to the Ministry of Public Health and the target hospitals, the hospitals in question are higher-level medical institutions, and whenever a physician determines that an X-ray is necessary, the examination is always carried out even if patients have to wait one to two weeks. Therefore, it is unlikely that such latent demand existed, and the target value appears to have been set too high.

Table 4. Changes in the Number of X-ray Images Taken

	Average in 2012-2014 (i)	2024 (ii)	Ratio (ii / i)
General X-ray	668 thousand/year	843 thousand/year	126%
Mammography	90 thousand/year	98 thousand/year	109%

Source: Preparatory survey report for 2012-2014; questionnaires and interviews with each hospital for 2024

Note: Numbers for General X-ray are the total of the 20 hospitals for which data are available; numbers for mammography are the total of the same 7 hospitals.

At the planning stage, it was assumed that the demand for examinations would increase with population growth, and the number of equipment units procured for each hospital was planned to meet that demand. It was projected that the number of examinations in 2024 would increase to approximately 117 – 118% of the 2012 – 2014 levels. Compared to the projections at the planning stage, the actual number of general X-ray examinations was slightly higher, while the number of mammography examinations was slightly lower.

(3) Qualitative Effects

According to the Ministry of Public Health and the target hospitals, the Project brought the following changes to the X-ray diagnostic imaging of the target hospitals.

Improvement in imaging efficiency: Unlike conventional (analog) or CR systems, FPD does not require cassette replacement for each exposure, allowing faster imaging and enabling more patients to be examined in a day. Both FPD and CR allow immediate image confirmation after exposure, so if a retake is necessary, it can be done on the spot. In contrast, in conventional systems, images had to be developed before confirmation, and if a retake was needed, the patient had to be called back for another exposure. Additionally, the processes of developing, fixing, and drying were required, which, except in some hospitals equipped with automatic processors, hindered rapid imaging.

Improvement in image quality: Compared to conventional systems, image quality is better and more stable (conventional systems had instability due to development). Furthermore, digital images can be easily adjusted for quality factors such as brightness and contrast, and can be enlarged, allowing detection of details that were not visible with conventional systems.

Acceleration of diagnosis: Whereas conventional systems require more than 30 minutes for film development, digital systems allow immediate viewing of images. Radiology specialists can promptly interpret the images and prepare diagnostic reports. If an intra-hospital network is available, responsible physicians in different locations can also view the images immediately.

Improvement of archiving: Images taken are stored on data servers and can be referenced immediately. Conventional X-ray films were difficult to retrieve from storage locations, making easy reference challenging. Additionally, films deteriorate quickly depending on storage conditions, making long-term preservation difficult. Digitalization has made it easier to perform progress analyses and case comparisons. This is useful not only for clinical practice but also for research and education. Many hospitals have established digital archives for educational purposes.

Reduction of consumable costs: Consumables such as X-ray film and developing chemicals became unnecessary, resulting in cost savings. Supply shortages of these items also no longer pose constraints.

Improvement of imaging environment: The developing process using various toxic chemicals required by conventional systems was eliminated. According to medical staff on site, the removal of developing work in a contaminated environment has made their work more "humane."

Development of intra-hospital networks: The data servers and network equipment provided by the Project have contributed to the development of digital networks within each hospital. Currently, most of the 24 target hospitals have intra-hospital networks that allow sharing of images throughout the hospital or within certain departments. It can be said that the Project, which led to the first comprehensive and systematic implementation of digital X-ray diagnostic imaging in Cuban medical institutions, served as a catalyst for the development of such intra-hospital networks. In five hospitals, the networks were strengthened through the JICA technical cooperation: "Project to Promote of Hospital Digitalization in Image Diagnosis," and leveraging these results, network enhancement is planned to be further advanced in another five hospitals. Additionally, some hospitals have established networks that allow sharing images with other hospitals or systems that enable image sharing via the web.

Improvement in image sharing: With the development of networks, responsible physicians can easily share images to seek opinions from other doctors and conduct case reviews. In some hospitals, images are shared via the web, enabling consultations with doctors working remotely while viewing the images.

Response to the COVID-19 pandemic: Since FPD does not require moving cassettes and other devices, healthcare workers can perform imaging with minimal contact with patients. Faster imaging has reduced patients' time to stay in hospitals. Image sharing enables non-contact consultations among multiple doctors. In some hospitals that accepted large numbers of patients during the pandemic, this greatly contributed to preventing nosocomial infections.

Reduction of radiation exposure: Digital systems expose patients to less than half the radiation per imaging compared to conventional systems. It is believed that radiation exposure for both patients and healthcare workers has decreased.

Reduction of waiting time: Before the Project, with conventional systems, rapid imaging was not possible, or the number of devices was insufficient, and supply shortages of films and developing consumables limited the number of images taken. As a result, waiting times from when the attending physician requested an examination until the actual imaging ranged from several days up to about two weeks. After the Project, all hospitals can perform imaging within the same day to about five days. Furthermore, the time from imaging to consultation was also significantly shortened due to the elimination of the developing process and the reduction of retakes after development.

3.3.1.2 Pathology Testing

(1) Operation and Utilization of the Equipment

The operational and utilization status of the main pathology testing equipment in the Project is as follows.

Table 5. Functional and Utilization Status of Equipment (Pathology Testing)

	Qty.	Function Percentage of equipment in "good" or "normal" functional condition*	Utilization Percentage of equipment in "very high" or "high" level of utilization**
Tissue processor	14	64%	43%
Automated embedding system	14	93%	57%
Microtome	14	86%	71%
Automated staining device	14	93%	57%
Binocular microscopes	84	100%	100%
Trinocular microscope	14	92%	100%
Pentaocular microscope	14	100%	92%
Polarized microscope	14	92%	69%
Cryostat	14	79%	64%

Source: Questionnaire survey and interview results from the target hospitals

Notes: * Refers to the functional condition of equipment procured under the Project. Responses were selected from four categories - "Good," "Normal," "Partially functional," and "Non-functional."

** Responses were selected from four categories - "Very high," "High," "Low," and "Very low."

There are many failures in the tissue processors and cryostats. The reasons cited include the inability to import and replace aging parts, and the inability to repair malfunctions believed to be caused by unstable voltage (although UPS units were provided, they have deteriorated and no longer function).

The tissue processors, automatic embedding devices, and automatic staining devices consume paraffin, various reagents, and staining solutions, but the consumption of these consumables is higher with the Project's equipment compared to the previous equipment. Due to limited supply of consumables, some hospitals continue to operate using the previous methods without using the new equipment. As a result, the utilization rates of the automatic embedding and automatic staining devices are lower than their operational status might suggest.

Various microscopes are being utilized; however, due to expired software licenses, many hospitals are unable to record and store digital images.

(2) Quantitative Effects (Indicators: reference information)

At the planning stage, the number of biopsy tests at 14 target hospitals was set as an indicator. In this ex-post evaluation, the number of biopsies conducted in 2024 was obtained from all target hospitals.

Table 6. Changes in the Number of Biopsies Performed (Pathology Testing)

	Average in 2012-2014 (i)	2024 (ii)	Ratio (ii / i)
Number of biopsies	114,917	45,671	40%

Source: Preparatory survey report for 2012-2014; questionnaires and interviews with each hospital for 2024

The number of biopsies conducted in 2024 decreased to 40% of the 2012 – 2014 levels. At the planning stage, it was assumed that the number of biopsies would increase with population growth and reach approximately 143% of the 2012 – 2014 levels by 2024. According to the Ministry of Public Health and the target hospitals, the decrease in biopsy numbers is mainly due to a reduction in the number of surgeries caused by shortages of personnel and supplies. The number of surgeries sharply declined during the COVID-19 pandemic period and has not fully recovered to previous levels since then.[12]

It was reported that in many hospitals, the supply of consumables for pathology testing is constrained, leading to reuse whenever possible and personal efforts by physicians to obtain necessary materials. However, there were no reports of surgeries being postponed or cancelled due to constraints in pathology testing. Based on the above, although the number of biopsies has significantly decreased, the Project's equipment is generally considered to adequately meet the pathology testing needs of each hospital.

[12] According to the Health Statistics Yearbook, the number of surgeries in 2022 remained at 59% of the 2013 level. Additionally, according to the Ministry of Public Health, in 2024 the medical oxygen production equipment broke down and was non-operational for six months, resulting in only urgent surgeries being performed over an extended period, which caused a significant decrease in the number of surgeries.

(3) Qualitative Effects

According to the Ministry of Public Health and the target hospitals, the Project brought about the following changes in the pathology testing departments of the target hospitals.

Acceleration of testing: Many tasks previously performed manually have been automated, allowing processing of a large number of samples at once, which has enabled faster testing. The time to obtain results has been reduced from approximately two weeks to two months down to several days to one week.

Improvement of test quality: Proper processes for formalin fixation, paraffin embedding, and precise thin sectioning have been established, enabling preparation of high-quality specimens. The microscopes provided by the Project have much higher performance compared to the aging existing microscopes. Many pathologists at the hospitals reported that the quality of pathology testing has improved dramatically and is vastly superior to before.

Promotion of education and research: The Project enabled capturing microscope photographs. The ability to take high-quality images of biopsy samples has facilitated the preparation and publication of high-quality cytological and histological research papers. Additionally, the educational pentaocular microscope is very useful for training medical personnel, allowing detailed teaching of cellular and tissue structures.[13]

3.3.1.3 Minimally Invasive Medicine

(1) Operation and Utilization of the Equipment

The operational and utilization status of the main medical devices of the Project's in minimally invasive medicine field is as follows.

Table 7. Functional and Utilization Status of Equipment (Minimally Invasive Medicine)

	Qty.	Function Percentage of equipment in "good" or "normal" functional condition*	Utilization Percentage of equipment in "very high" or "high" level of utilization**
Gastrointestinal Endoscopy System	6	83%	83%
Laparoscopy System	6	67%	67%
Bronchoscopy System	5	60%	60%

Source: Questionnaire survey and interview results from the target hospitals

Notes: * Refers to the functional condition of equipment procured under the Project. Responses were selected from four categories - "Good," "Normal," "Partially functional," and "Non-functional."

** Responses were selected from four categories - "Very high," "High," "Low," and "Very low."

[13] In addition to education for medical students and residents, several hospitals provide training for international students from Latin America, Middle East, Africa, etc.

There are many failures of the flexible videoscopes used for gastrointestinal endoscopy and bronchoscopy. They are prone to damage such as punctures, cable breaks, and fiber optic fractures caused by improper operation, patient reactions (e.g., accidental biting), and inadequate cleaning (rough handling, insufficient drying, improper detergent use).Repairs of videoscope failures are carried out by CNE technicians trained by the manufacturer, but those that cannot be repaired domestically are sent to the manufacturer in Japan for repair. So far, eight videoscopes have been deemed unrepairable within the country and were repaired or replaced in Japan. In some hospitals, due to heavy usage from high testing demand and handling by inexperienced resident doctors, measures have been taken after repairs to limit the number of examinations, prohibit residents from handling the equipment, and ensure proper use of appropriate detergents and genuine biopsy forceps. Failures of video processors have also occurred in some equipment.

(2) Quantitative Effects (Indicators: reference information)

The operational and utilization status of the main medical devices of the Project's in minimally invasive medicine field is as follows.

Table 8. Changes in the Number of Endoscopic Examinations and Surgeries[14]

	Average in 2012-2014 (i)	2024 (ii)	Ratio (ii / i)
Number of Upper and Lower Endoscopic Examinations	24,536	10,794	44%
Number of Laparoscopic Surgeries	7,816	3,143	40%

Source: Preparatory survey report for 2012-2014; questionnaires and interviews with each hospital for 2024

The number of examinations and surgeries in 2024 both decreased to about 40% of the levels in 2012 – 2014. At the time of planning, it was assumed that the numbers of examinations and surgeries would increase with population growth and reach approximately 130% of the 2012 – 2014 levels by 2024. According to the target hospitals, the decrease in examinations was mainly due to equipment being unusable for extended periods during repairs and shortages of consumables such as appropriate cleaning solutions. The decrease in surgeries was caused by the reduction in surgery numbers mentioned above.

Regarding endoscopic examinations, the number of endoscopes available domestically is limited, resulting in some hospitals receiving requests for examinations from other hospitals,

[14] The preparatory study and the ex-ante evaluation sheet identified the "number of upper and lower endoscopies and laparoscopic examinations" and "number of upper and lower endoscopies and laparoscopic surgeries" as indicators; however, upon confirmation with the consultants, the correct indicators were "number of upper and lower endoscopic examinations" and "number of laparoscopic surgeries." In the ex-post evaluation, performance data were collected from six target hospitals.

and thus the demand is not fully met.

(3) Qualitative Effects

According to the Ministry of Public Health and the target hospitals, the Project brought about the following changes in the minimally invasive medicine of the target hospitals.

High image quality and high performance: Most of the existing endoscopes (for the gastrointestinal tract and bronchi) which had been used at the target hospitals lacked video monitors, so physicians had to look directly into the endoscope for diagnosis. The field of view was narrow, and the images had optical limitations. Only the examining physician could see the images, and recording or storing the images was not possible. In contrast, the endoscopes procured through the Project are video-based and provide clear images through high-resolution cameras. Images can also be magnified on the monitor as needed. Additionally, narrow-band imaging (a technique that uses specific wavelengths of light to clearly observe fine blood vessels and mucosal structure changes) has enabled the detection of early lesions.

Video display system: Examinations are performed while viewing the monitor screen, which improves operability. Multiple people can observe simultaneously, and still images and videos can be easily recorded. This capability is highly useful not only for clinical purposes but also for educational objectives.

Facilitates biopsy: When suspicious lesions (such as polyps, ulcers, or discolorations) are found, a specialized forceps is used to grasp and collect tissue samples for pathological examination to confirm cancer diagnosis. Although biopsy could be performed with conventional endoscopes, their narrow field of view and limited visualization of the entire lesion made it difficult to accurately determine the biopsy site. Additionally, bleeding after tissue sampling can be closely monitored, enabling the procedure to be performed safely.

3.3.1.4 Summary of Effectiveness

Based on the above, the achievement status of the objectives for each field is summarized as follows.

X-ray Imaging: Although some equipment has deteriorated due to heavy use, overall, the equipment is being adequately utilized. Faster and more accurate imaging diagnosis has become possible. Therefore, the objectives of this field have been fully achieved.

Pathology Testing: Although some equipment has become unusable due to breakdowns, the equipment is generally well utilized, enabling faster and more accurate testing at each hospital. While the demand for tests has significantly decreased compared to the planned forecast due to a reduction in surgeries caused by shortages of personnel and supplies, the necessary biopsies are being performed. Therefore, the objectives of this field have been largely achieved.

Minimally invasive medicine: The equipment has advanced functions and high-performance, contributing to accurate diagnosis and treatment of cancer and other diseases. However, about one-third of the equipment is not operational due to breakdowns of video scopes and other devices, and supply constraints of consumables have also limited the ability to meet examination demand. Additionally, the number of laparoscopic surgeries has decreased significantly compared to projections due to the overall reduction in surgical cases. Therefore, the objectives of this field have been partially achieved.

Based on the above, the effectiveness of the Project can be summarized as follows: the X-ray imaging field (24 hospitals) fully achieved its objectives; the pathology testing field (14 hospitals) mostly achieved its objectives; and the Minimally invasive medicine field (6 hospitals) partially achieved its objectives. Taking into account the level of achievement in each field and the number of hospitals covered, it is assessed that the overall objective of the Project "to enhance cancer diagnosis and minimally invasive medicines" was mostly achieved.

3.3.2 Impacts

3.3.2.1 Intended Impacts

According to the target hospitals, the Project has enabled faster and more accurate diagnoses, which has led to more appropriate treatment and had a significant impact on the diagnosis and treatment of cancer and other diseases. Specifically, the following impacts were reported:

X-ray imaging

- Early diagnosis of many malignant diseases has become possible, leading to earlier treatment and improved survival rates.
- It has greatly contributed to the early detection of breast cancer and the timely staging of the disease after diagnosis.
- The equipment has been extremely useful in diagnosing urological conditions such as urolithiasis, as well as rheumatic diseases, neurological disorders, endocrine and metabolic diseases, kidney diseases, muscular disorders, and other surgical conditions. Thanks to the high image quality, small lesions in the lungs and bones can now be detected at an early stage, enabling appropriate treatment. It has also become possible to diagnose mediastinal lesions and metastatic lesions in the spine and skull.

Pathology testing

- It became possible to assess factors that influence the prognosis of cancer patients, such as cancer progression, risk of recurrence, and survival rates.
- Cytological and histological diagnoses of various diseases – including cancer, inflammatory diseases, and infectious diseases – are now feasible.
- Positive cases of cancer can be diagnosed within a few days, enabling prompt initiation of treatment.
- The number of dermatological diagnoses has increased due to their use in Hansen's disease screening. It also became possible to determine whether conditions such as thyroid atrophy are of surgical pathological nature or not.

Minimally invasive medicine

- Precancerous lesions and malignant diseases can now be detected at earlier stages, contributing to improved survival rates through timely diagnosis and treatment.
- Being able to visually confirm lesions and accurately collect tissue samples has improved diagnostic accuracy and helped optimize subsequent treatment plans.
- Bronchoscopies have enabled more accurate diagnosis and treatment of conditions such as lung cancer, bronchial cancer, pneumonia, and tuberculosis.
- The equipment has proven useful in the accurate diagnosis of conditions such as Barrett's esophagus, esophageal varices, and upper gastrointestinal bleeding. Some lesions can now be treated endoscopically, eliminating the need for open surgery and reducing the physical burden on patients.

At the time of planning, one of the identified challenges was that patients were often forced to travel to or be referred to cancer treatment centers in other regions.[15] According to the Ministry of Public Health and the target hospitals, the improvement of medical equipment through the Project may have contributed to a reduction in such referrals and inter-regional travel for treatment. However, each of Cuba's western, central, and eastern regions has its own well-equipped hub hospitals, and medical services – except for specialized treatments – are generally completed within each respective region. This also applies to the eastern region, where many low-income populations reside.

All of the target hospitals reported that the Project contributed to increased patient satisfaction. In particular, the reduction in waiting times for X-ray imaging – both the wait until the day of the examination and the time from imaging to diagnosis – helped alleviate the burden on patients. The transition from conventional to digital imaging methods brought about tangible changes that patients could directly experience, and without exception, those patients interviewed at the target

[15] There are eight cancer treatment regions throughout Cuba.

hospitals expressed appreciation for this change.

According to the Ministry of Public Health, both the early detection rate and the five-year survival rate for breast and colorectal cancer have declined compared to the period before the Project. This decline is attributed to a sharp decrease in cancer diagnoses and surgeries during the COVID-19 pandemic, as well as ongoing shortages of human and material resources that continue to affect healthcare services. During the approximately two-year pandemic period, people were unable to visit medical facilities, which led to a decrease in early detection and a subsequent increase in the diagnosis of advanced-stage cases. Furthermore, Cuba's recent severe economic situation has imposed serious limitations on the maintenance of healthcare services. Therefore, it cannot be conclusively stated that the overarching goal of "expansion and improvement of healthcare services" has been fully achieved. However, there is no doubt that the situation would have been even more severe without the Project, which has made certain contribution to the expansion and improvement of healthcare services.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Environment and Social Aspects

At the planning stage, the Project was assessed under the "JICA Guidelines for Environmental and Social Considerations" (issued in April 2010) and was determined to have minimal adverse environmental impact. No negative environmental impacts were reported by the Ministry of Public Health or the target hospitals. The digitization of X-ray imaging eliminated the film development process that uses hazardous substances and also contributed to a reduction in radiation exposure for both patients and medical personnel. These outcomes represent positive environmental impacts.

(2) Impacts on Gender Equality, Marginalized People, Social Systems and Norms, People's Well-being and Human Rights

The provision of mammography equipment contributed to appropriate screening for breast cancer and other conditions, and is considered to have had a positive impact on women. The Project covered major hospitals across the country. While the Project was not specifically designed to target socially marginalized groups or those living in poverty, all medical services in Cuba are provided free of charge, and it is therefore considered that the entire population has benefited equitably from the Project.

(3) Other Positive / Negative Impacts

In all medical institutions in Cuba, training and development of medical personnel is conducted in an organized manner. The medical equipment provided by the Project – such as the establishment of image archives (digitalization of diagnostic imaging), sharing of examination images (pathology: use of multi-head microscopes), and screen sharing (minimally invasive medicine: display of examination images on monitors) – has enabled more efficient and effective training of medical personnel. The ability to conduct higher-precision examinations and to capture examination images has also had a significant impact on medical research.

To summarize the effectiveness and impact: the equipment provided by the Project has been well utilized, contributing to faster and more accurate medical care. The Project's objective to "enhance cancer diagnosis and minimally invasive treatments" has been largely achieved. Positive impacts have emerged in clinical practice, contributing to the higher-level goal of "the expansion and quality improvement of healthcare services."

Therefore, effectiveness and impacts of the Project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

As stated in "3.1.1 Relevance," the provision of free medical services to all citizens is a national priority in Cuba. Therefore, there are no policy or institutional challenges regarding the sustainability of the Project.

3.4.2 Institutional/Organizational Aspect

All medical institutions in Cuba operate under the government; there are no private medical facilities. The Medical Technology, Consumables, and Clinical Furniture Bureau (hereinafter simply "Medical Technology Bureau"), under the Directorate of Pharmaceuticals and Medical Technology of the Ministry of Public Health, monitors the status of all medical equipment and systematically plans and procures medical devices, consumables, and medical furniture. Under each provincial Health Directorate, the Hospital Bureau, together with the Medical Technology Bureau, supervises the operation of medical equipment procured for the target hospitals under the province (29 out of 34 hospitals) and determines plans and priorities related to medical equipment, spare parts, and hospital digitization. The remaining hospitals are directly overseen by the Ministry of Public Health.

CNE, under the Ministry of Public Health, is the central institution responsible for the installation, commissioning, repair, and maintenance of all medical equipment within the national healthcare system. It plans the procurement of necessary spare parts and technical inputs for Cuba and oversees 37 provincial centers (CPE) and regional centers (CTE) across the country. There are no manufacturer branches in Cuba that handle medical equipment repairs; all repairs are conducted by CNE, CPE, and CTE. Equipment that cannot be repaired by the CPE or CTE is sent to the CNE headquarters in Havana, where specialized technicians carry out repairs. If repairs cannot be performed at the CNE either, the equipment is sent abroad to manufacturers for servicing.

In each hospital, the radiology department operates the imaging diagnostic equipment, while the pathology department manages the pathology testing equipment. Endoscopy equipment is operated by departments such as gastroenterology, gastrointestinal surgery, and respiratory medicine. Each hospital has an Electrical Medical Equipment Department, which conducts inspection and repairs of electrical medical devices, receiving support from CNE, CPE, or CTE as needed. Equipment that cannot be repaired by this department is sent to CPE, CTE, or CNE for repair.

Due to recent outflows of personnel, some target hospitals' Electrical Medical Equipment Departments have only a fraction of their authorized staff, and in some cases, no staff at all. Similarly, CNE, CPE, and CTE are also experiencing staff shortages; although there is a total authorized staffing of approximately 3,700 personnel, one-quarter of these positions are vacant. At CNE specifically, half of the positions are unfilled. To address this, CNE is considering leveraging the high technical skills of its employees by establishing a small- to medium-sized enterprise that provides paid services to public organizations outside the health sector as well as to private companies such as hotels. This initiative aims to promote financial independence and improve staff retention.

Based on the above, although the organizational structure is established, the shortage of personnel due to staff outflow remains a challenge.

3.4.3 Technical Aspect

In the Project, training was provided to hospital equipment operation staff and technicians at CNE/CPE/CTE through initial guidance at equipment installation, manufacturer-led training in Japan included in the equipment procurement contracts, consultant-led training (software components), and maintenance contracts.

According to interviews with the target hospitals and on-site inspections, no technical issues were observed regarding the operation of equipment procured through the Project. The personnel at the target hospitals possess sufficient knowledge and experience to properly operate the equipment and conduct medical examinations.

When CNE procures new medical equipment from overseas manufacturers, it always includes factory-based training by manufacturer engineers in the contract, aiming to develop specialized personnel with advanced repair skills for the respective equipment. In the Project as well, training was conducted as part of the equipment procurement contracts, involving digital imaging diagnostics (FUJI Film), endoscopy (Olympus), and pathology testing (Sakura Finetek). Notably, two technicians received training and manufacturer certification from Olympus, leading to the establishment of a dedicated department within CNE specializing in the repair of Olympus products. Overall, CNE's specialized technicians possess high capabilities. For example, at one target hospital, CNE technicians independently conducted CT scanner repairs and trial operations without relying on the manufacturer, and there was even a case where they devised a new X-ray imaging device by combining broken existing equipment.

However, among the personnel who received training through the Project's soft components, only about 20% remain at hospitals in Havana, and approximately half remain in provincial areas. Additionally, all of the specialized technicians trained by Olympus for endoscopy have left their positions. The manuals for the Project's medical equipment are used by CNE / CPE /CTE and the electrical medical equipment departments of each hospital. While some manuals have been properly preserved, many are believed to have been lost due to staff turnover.

Spare parts are procured by the Ministry of Public Health and distributed to CNE / CPE / CTE. Although this is done on a planned basis, due to government budget constraints and the impact of U.S. economic sanctions, the required spare parts are not always immediately available. When imports are necessary, it can take six months to over a year from application to supply.

On the other hand, CNE has developed and continues to improve a centralized database that consolidates operational and maintenance information for electrical medical equipment across all medical institutions nationwide. This system is designed to enable planned procurement of medical devices and spare parts, with each piece of equipment linked to relevant healthcare programs (such as cancer programs, maternal and child health programs, etc.), allowing for strategic procurement aligned with the priorities of each program. Utilizing this database, CNE aims to implement not only preventive maintenance and repairs but also predictive maintenance. However, frequent nationwide power outages and personnel shortages have hindered the timely input and updating of information.

In summary, due to severe personnel outflow and budget constraints, there are challenges to the technical sustainability of the Project.

3.4.4 Financial Aspect

According to the Medical Technology Bureau, reflecting the severe fiscal situation and foreign currency shortages, the budget for procuring medical equipment and replacement parts has been gradually decreasing over the past several years. Specific data on the budget allocated for the operation and maintenance of the medical equipment provided under the Project, as well as the overall budget of the Medical Technology Bureau, were not available.

Due to the impact of U.S. economic sanctions, options for importing replacement parts into Cuba are limited. Direct shipment and bank transfer from exporting countries are difficult, often requiring transit through multiple third countries, which significantly increases costs. The unavailability of trade insurance also contributes to rising prices. These circumstances, combined with budget constraints, further complicate the procurement of replacement parts.

Based on the above, there are challenges regarding the financial sustainability of the Project.

3.4.5 Environmental and Social Aspect, Preventative Measures to Risks

Regarding the sustainability of the Project, there are no particular concerns related to environmental and social considerations or risk management.

3.4.6 Status of Operation and Maintenance

The operation and maintenance status of the medical equipment under the Project is as described in the "Effectiveness" section, with functioning equipment being adequately utilized. However, in the digital imaging diagnosis department, many faults have occurred in FPDs; in the pathology department, tissue processors; and in the minimally invasive medical department, video scopes for endoscopes and bronchoscopes. Approximately 20–30% of the equipment is either non-functional or has significant issues. Additionally, frequent malfunctions occur with UPS units and PCs. While many failures are due to excessive use and improper handling, repairs are often not possible because of shortages of replacement parts and insufficient technical skills and personnel. Therefore, there are challenges in the operation and maintenance of the equipment under the Project.

In summary, there are no issues regarding policy / system, institutional / organizational, environmental and social aspects, or risk management related to the sustainability of the Project. However, due to the recent severe economic situation, significant outflow of personnel from the public sector has occurred. As a result, human resource shortages pose a challenge at the institutional / organizational level, and the loss of trained personnel is a concern in terms of technical capacity. On the financial side, financial constraints make it difficult to procure replacement parts in a timely manner. Therefore, it is difficult to operate and maintain some equipment.

Therefore, sustainability of the project effects is moderately low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented with the objective of enhancing cancer diagnosis and minimally invasive medicines by equipping major medical facilities in Cuba with the necessary equipment for digitizing medical imaging diagnostic systems, pathology testing, and minimally invasive medicine, thereby contributing to the expansion and improvement of healthcare services and quality in the country. The Project was found to be highly consistent with Cuba's development plans and needs at both the planning and ex-post evaluation stages, as well as with Japan's development cooperation policy at the planning stage. Concrete synergies with other JICA projects were also observed. Therefore, its relevance and coherence are high. The project outputs were generally delivered as planned and within budget; however, the project period significantly exceeded the plan. Therefore, efficiency of the Project is moderately low. The equipment provided by the Project has been effectively utilized, resulting in faster and more accurate medical diagnosis and treatment. The Project's objectives were fully achieved in the field of X-ray diagnostic imaging (24 hospitals), mostly achieved in the field of pathology testing (14 hospitals), and partially achieved in the field of minimally invasive medicine (6 hospitals). These efforts have had a significant impact on the diagnosis and treatment of cancer and other diseases. Therefore, effectiveness and impacts of the Project are high. In terms of sustainability, there are no major issues from policy and system, environmental and social, or preventive measures to risks aspects. However, due to the country's recent severe economic situation, there has been a major outflow of human resources from the public sector. Consequently, a shortage of personnel in terms of organizational structure and a loss of trained human resources in terms of technical capacity have become issues. On the financial side, financial constraints make it difficult to procure replacement parts in a timely manner. Consequently, it is difficult to operate and maintain some equipment. Therefore, sustainability of the project effects is moderately low.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- The Ministry of Public Health should strive for the planned supply of necessary consumables and replacement parts to further enhance the effective utilization of the equipment provided by the Project. In addition, it is desirable that the Ministry undertake the following measures for the operation and maintenance of equipment in each department.

  - ➢ Regarding the digitalization of image diagnostics, based on the history of frequent damage to FPDs and CR cassettes, compile and summarize guidelines on their proper handling and thoroughly enforce these among the target hospitals. These guidelines should also be promptly shared with other medical institutions nationwide where similar equipment has been supplied by UNDP.

  - ➢ Regarding endoscopes, encourage the manufacturer's distributor to support the development of new human resources at the manufacturer. Compile lessons learned from past experiences on proper handling of the equipment and share them with the target hospitals.

- Considering that tissue processors and other equipment in the pathology department— which were not covered under the maintenance contract—have become bottlenecks, conduct a comprehensive nationwide inspection of all such equipment and examine appropriate countermeasures.

- The Ministry of Public Health should leverage the experience gained from the Project and the "Project to Promote Hospital Digitalization in Image Diagnosis" to properly advance the digitalization of imaging diagnostics across hospitals nationwide. They should make full use of the core personnel requested by the project, promote the development of networks suited to the existing infrastructure and needs of each hospital, and consider initiatives for sharing imaging information between hospitals.

4.2.2 Recommendations to JICA

JICA will monitor the implementation status of the above recommendations by the executing agency and provide advice as needed to promote their execution.

4.3 Lessons Learned

Project plan to maximize synergy through coordination between Grant Aid and Technical Cooperation

Two Technical Cooperation projects were implemented in relation to this Grant Aid project. The first Technical Cooperation was planned and initiated concurrently with this Grant Aid project; however, there was no concrete plan or coordination to achieve synergy between the two. Due in part to delays in implementing the Grant Aid project, the synergy effects were limited. The second Technical Cooperation was launched after the completion of this Grant Aid project. It effectively utilized the outcomes of the Grant Aid project and, through its activities, strengthened the effectiveness, impact, and sustainability of the Grant Aid project. This cooperation focused specifically on the challenge of digitalizing diagnostic imaging, and the fact that the target hospitals were already using equipment provided by the Grant Aid project and had clearly identified operational and maintenance issues contributed to the enhanced synergy.

Based on the above, in order to achieve high synergy effects between Grant Aid and Technical Cooperation projects, it is important to appropriately narrow down the issues to be addressed and to concretely plan the coordination between the activities and outputs of both projects. Additionally, simultaneous implementation of both projects is not essential for achieving high synergy effects. It is also possible to achieve significant synergy by initiating one project after the completion of the other.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective (none)

5.2 Additionality (none)

(End)