Republic of Ghana

FY2021 Ex-Post Evaluation Report of
Japanese Grant Aid Project
"The Project for the Construction of Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research"

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0. Summary

This project was intended to improve the research, testing and educational functions of the Noguchi Memorial Institute for Medical Research (hereinafter referred to as the NMIMR) by constructing the Advanced Research Center for Infectious Diseases (ARC[1]), thereby contributing to strengthening the capacity to respond to infectious diseases in Ghana and West Africa as a whole. This project was in line with Ghana's development policy and development needs, as well as Japan's development cooperation policy at the time of planning, as it aimed to contribute to capacity strengthening of Ghana and West Africa to respond to infectious diseases, through improving the functions of the NMIMR. Synergies between this project, a Science and Technology Research Partnership for Sustainable Development (SATREPS) program, and the Third-country Training were anticipated at the time of planning, and synergies were observed when these projects were implemented as planned. Although there has been no collaboration or coordination at the time of planning for projects other than JICA, training by other donors and research with Japanese universities were implemented at ARC due to coordination at the time of implementation, and mutual linkage was recognized. Therefore, its relevance and coherence are high. The outputs of this project were mostly achieved. Although the project period exceeded the plan, the project cost on the Japanese side was within the plan. Therefore, efficiency of the project is high. Regarding the project objective, i.e., improvement of the NMIMR's function, the indicators for both quantitative and qualitative effects have been achieved, and the expected impact has been realized. Therefore, effectiveness and impacts of the project are high. Slight issues have been observed in the technical aspect concerning the operation and maintenance of the project. However, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high. In light of the above, this project is evaluated to be highly satisfactory.

[1] People associated with the NMIMR often call it by the abbreviation ARL (Advanced Research Laboratories).

1. Project Description

Project Location

(Source: developed by the evaluator)

The whole view of ARC at NMIMR

(Source: photo taken by the evaluator)

1.1 Background

At the time of planning, the Ministry of Health, Ghana formulated a development plan to achieve the Millennium Development Goals (MDGs) and was working on measures against infectious diseases and aiming to improve the health of pregnant women and children under the age of five. Furthermore, lifestyle-related diseases were becoming an issue due to changes in the disease structure. The NMIMR was established in 1979 with support from Japan as a medical research institute that conducts research, surveys, and special tests, and fosters researchers to address these health issues. Japan's grant aid and technical cooperation over many years have improved its research capabilities, making it an institute that can widely contribute to international infectious disease control issues, including those in West Africa. As a result, the NMIMR addressed research on nutrition issues, cancer, and vaccine development in addition to research on major infectious diseases such as HIV/AIDS, malaria, tuberculosis, and neglected tropical diseases (NTDs), in collaboration with international organizations, government agencies, NGOs, universities, and so on. During the calamity of Ebola haemorrhagic fever that started in 2014, the NMIMR diagnosed many suspected cases as the only laboratory that can test for Ebola haemorrhagic fever in Ghana. Along with the increase of these activities, the number of personnel (including researchers) increased sharply, with an annual average increase of about 5%. In particular, development in the field of molecular biology was remarkable, and demand expanded. In addition, the number of surveys related to infectious disease control and the number of interns accepted increased. On the other hand, the existing facilities' capacity became insufficient, which

hindered the required research and examination/diagnosis work. In addition, aging facilities and equipment made it difficult to conduct work safely and effectively, and there was concern that the quality of research would decline.

Under these circumstances, to further improve the NMIMR's research, inspection, and educational capacities, the government of Ghana requested that the government of Japan provide grant aid for the construction of an additional laboratory building and the provision of research equipment.

1.2 Project Outline

The objective of this project is to improve the NMIMR's research, testing, and educational functions by constructing the Advanced Research Center for Infectious Diseases, thereby contributing to a stronger capacity to respond to infectious diseases in Ghana and all of West Africa.

<Grant Aid Project>

Grant Limit / Actual Grant Amount		2,285 million yen / 2,182 million yen
Exchange of Notes Date / Grant Agreement Date		May 2016 / May 2016
Executing Agency		NMIMR
Project Completion		March 2019
Target Area		Accra City
Main Contractors	Construction	Shimizu Corporation
	Equipment	Sirius Corporation
Main Consultants		NIHON SEKKEI, INC., Fujita Planning Co., Ltd.
Preparatory Survey		February 2015–October 2015
Related Projects		**Technical Cooperation Project** - Noguchi Memorial Institute Project (Phase I & Phase II) (1986–1997) - The Infectious Disease Project at Noguchi Memorial Institute for Medical Research in Ghana (1999–2003) - West African Centre for International

	Parasite Control (WACIPAC) Project (2004–2008) **Grant Aid Project** - Postgraduate Medical Research Institute, University of Ghana Medical School (1977) - "The Project for Improvement of Noguchi Memorial Institute for Medical Research (Phase 1 & Phase 2) (1998)

2. Outline of the Evaluation Study

2.1 External Evaluator

Mayumi Hamada, Foundation for Advanced Studies on International Development (FASID)

2.2 Duration of Evaluation Study

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

Duration of the Study: December 2021–March 2023

Duration of the Field Study: May 23, 2022–June 9, 2022,
September 11, 2022–September 17, 2022

3. Results of the Evaluation (Overall Rating: A[2])

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

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Ghana

At the time of planning, *Ghana Shared Growth and Development Agenda II (2014–2017),* the country's national development plan, stipulated that it would intensify advocacy to reduce infectious diseases such as malaria, HIV/AIDS, and tuberculosis (TB).[4] In addition, among the six policy goals set in the *Health Sector Medium Term Development Plan* (hereinafter referred to as *HSMTDP*) *2014–2017*, Goal 5 (strengthening of a national system to achieve the MDGs and ensure sustainability of results, including expanding the implementation of the National Strategic Plan for Control of TB, AIDS, etc.) and Goal 6 (strengthening the prevention and control of non-infectious and infectious diseases, including eradicating polio and strengthening comprehensive

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ④: Very High、③: High, ②: Moderately Low, ①: Low
[4] *Ghana Shared Growth and Development Agenda II 2014-2017* p221

communicable disease surveillance) matched the NMIMR's function and role.

At the time of the ex-post evaluation, the *National Medium-term Development Policy Framework (2022–2025)* indicated its goal in social aspect that high-quality universal health coverage accessible to all should be ensured and morbidity, mortality, sexually transmitted diseases, HIV/AIDS, and other infectious diseases be reduced. In addition, *HSMTDP 2018-2021* set a goal of taking measures against infectious diseases in "Coverage of essential health services", while *HSMTDP 2022–2025* referred to enhancing the management and quality of national laboratories and infectious disease centres as a part of improving the quality of medical services and information management. *Ghana's Roadmap for attaining Universal Health Coverage 2020–2030* also listed diseases to be eradicated, such as onchocerciasis, yaws, yellow fever, and schistosome. Furthermore, it pointed out that polio, lymphatic filariasis, trachoma, and measles should be kept under high surveillance to avoid exacerbation, and spread of cholera and meningitis be controlled at levels that do not pose public health problems. Thus, at the time of the ex-ante and ex-post evaluations, this project has been consistent with Ghanaian policy.

3.1.1.2 Consistency with Ghana's Development Needs

At the time of planning, infectious diseases such as malaria, bronchitis, HIV/AIDS, and diarrhoea accounted for more than 70% of major diseases in Ghana. At the time of the ex-post evaluation, malaria, bronchitis, and HIV/AIDS still ranked high among the number of people infected with infectious diseases.[5] The importance of measures against infectious diseases remains high, particularly due to the COVID-19 pandemic and emergence of new variant strains.[6] The number of people infected with COVID-19 in Ghana and its neighbouring countries in the West African region is shown in Table 1. Compared to neighbouring countries, Ghana has a higher number of infected people per 100,000 individuals. In addition, at the beginning of the outbreak in Ghana in 2020, the NMIMR's laboratory was the only one laboratory, which could conduct PCR Tests. Therefore, at the time of planning and ex-post evaluation, this project was consistent with the development needs of Ghana and West Africa.

[5] Interview with Ministry of Health
[6] Questionnaire to Ghana Health Service

Table 1 Number of People Infected with COVID-19

(Unit: persons)

Country	Cumulative Number of Infected People	Cumulative Number of Infected People per 100,000
Ghana	168,580	543
Cote d'Ivoire	86,760	329
Togo	38,517	465
Guinea	37,470	285
Benin	27,490	227
Burkina Faso	21,128	101
Liberia	7,883	156
Sierra Leone	7,747	97

Source: https://covid19.who.int/WHO-COVID-19-global-table-data.csv[7]

3.1.1.3 Appropriateness of the Project Plan and Approach

Sufficient gender consideration was given during the planning and implementation stages so that women would not be disadvantaged. Consideration was also given to avoid disadvantages of people with disabilities, such as installing an elevator.[8] Including these issues, no problems were found in the planning and approach of this project.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

In the *Country Assistance Policy for the Republic of Ghana (2013)* and *JICA Country Analysis Paper (2013)*, which were valid at the time of planning, health was a priority area, and measures against infectious diseases were planned to achieve MDG6. Therefore, at the time of planning, this project was consistent with Japan's aid policy.

3.1.2.2 Internal Coherence

At the time of planning, the JICA Ghana Office assumed synergetic effects between this project, a SATREPS, and the Third-country Training shown in Table 2.[9]

[7] Accessed on September 5, 2022
[8] Questionnaire to and Interview with the NMIMR
[9] Questionnaire to JICA Ghana Office

Table 2 Related JICA Projects

	Category	Name	Duration
1	SATREPS	The Project for Surveillance and Laboratory Support for Emerging Pathogens of Public Health Importance	2016-2022
2	Third-country Training	Third Country Training Course on Enhancing Laboratory Skills for Infectious Diseases in West African Countries for Post Ebola	2018-2021
3	Third-country Training	Third Country Training Course on Enhancing Testing Skills for Infectious Diseases in West African Countries	2021-2024

Source: JICA Website (https://www.jica.go.jp/oda/project/1500611/index.html),[10] Questionnaire to JICA Ghana Office

The relationships and synergetic effects between each project in Table 2 and this project are as follows.[11]

Regarding 1 in Table 2, there was a direct synergetic effect in that it became possible to conduct high-quality research by using the facilities and equipment provided by this project. As for 2, it is recognized this project has made it possible to conduct training using advanced facilities and equipment at ARC. In addition, ARC has a training room and a training lab, and it was very beneficial to be able to accept more trainees. In light of the above, effects were expected through collaboration with other JICA projects at the planning stage, although specific targets were not set for the expected effects. After project completion, other JICA projects involved research and training by utilizing the ARC effectively. This shows the improved function of the NMIMR (the project's objective) and contributed to enhancing its capacity to respond to infectious diseases in Ghana and West Africa (expected impact).

3.1.2.3 External Coherence

At the time of planning, the Danish International Development Agency, the Bill & Melinda Gates Foundation, the U.S. Centers for Disease Control and Prevention, the U.S. National Institutes of Health, the Volkswagen Foundation, and others were conducting joint research with the NMIMR in the field of infectious diseases.[12] However, evidence was not found that planning, coordination, or agreement were made in advance regarding the specific effects of collaboration between this project and others. In addition, in the *Yokohama Plan of Actions* adopted at the 5th Tokyo International Conference on African Development (TICAD V, 2013), infectious disease control was a priority item in the health sector.[13]

Regarding collaboration with other organizations after project completion, the NMIMR conducted a genetic analysis training (for two weeks, with 10 participants from neighbouring countries) by utilizing ARC in collaboration with the West Africa Health Organization (WAHO)[14] and the African Center for Disease Control and Prevention (Africa CDC), contributing to COVID-

[10] Accessed on January 31, 2022
[11] Questionnaire to and Interview with the NMIMR, Questionnaire to JICA Ghana Office
[12] The Ex-ante Evaluation Sheet, p2
[13] TICAD V Yokohama Plan of Actions 2013–2017
[14] WAHO is a specialized institution of Economic Community of West African States (ECOWAS).

19 countermeasures in neighbouring countries.[15] As for collaboration with Japanese organization other than JICA, a project titled "the Establishment of Network for Research and Control of Infectious Diseases based on the Research Center in West-African Subregion"[16] was conducted at the NMIMR. This project was a part of the Japan Agency for Medical Research and Development (AMED)'s "Japan Initiative for Global Research Network on Infectious Diseases" (J-GRID). Even after the completion of this project, the infectious disease research project at the Tokyo Medical and Dental University in Ghana was continuing at the time of the ex-post evaluation, utilising ARC and receiving financial support from local Japanese companies.[17] Although specific collaboration/coordination was not envisaged at the time of planning for these projects, synergetic effects in training and research can be observed through collaboration/coordination after the project completion. In addition, at the time of the ex-post evaluation, six Japanese universities and research institutes were conducting joint research with the NMIMR.[18] Four universities and research institutes (National Institute of Infectious Diseases, TMDU, Mie University/Mie University Hospital, and Ehime University) among the six were conducting research utilising ARC,[19] and harmonisation with this project is observed.

This project is highly consistent with Ghana's development plan and development needs, and there are no problems with its project plan or approach. In addition to being consistent with Japan's ODA policy at the time of planning, mutual complementary and synergetic effects can be observed with other projects supported by JICA and other development agencies. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

3.2.1.1 Japanese Side

(1) Facility construction

The construction of facilities in this project was carried out as planned, except for minor changes (Table 3).

[15] Questionnaire to JICA Ghana Office, Interview with the NMIMR
[16] 2015–2019, Representative Researcher: Prof. Shiroh Iwanaga, Tokyo Medical and Dental University (TMDU), https://www.amed.go.jp/program/list/01/06/001.html, accessed on January 31, 2022
[17] Interview with teaching staff at TMDU
[18] National Institute of Infectious Diseases, Kitasato University, Nagasaki University, TMDU, Mie University/Mie University Hospital, Ehime University. Interview with the NMIMR
[19] Interview with the NMIMR

Table 3 Facility Construction Plans and Results

Component		Contents of facilities	
		Plan	Results
ARC		Three-story, 4,597.50 m^2 West wing, North wing (See below for details)	Mostly no change, though the BSL-3 Labs became two, while storage space was eliminated.
	West wing	Administration dept., student service office, professor room, seminar room, project room, data processing unit room, storage	
	North wing	Laboratories, Biosafety Level 3 (BSL-3) laboratory, BSL-3 administrative office, washing room, cold (freezer) room, storage, researcher/research assistant/technician office, seminar room, administration dept.	
Attached wings		372 m^2 (See below for details)	
	Water tower / Reservoir building	Single-story, 40 m^2 Elevated water tank space, water reservoir room, pump room	No change
	Sub-station	One-story, 77.65 m^2 High tension volt room, transformer room, low tension volt room	No change
	Machine building	One-story, 196.23 m^2 Generator room, oil tank space (outside of the building), workshop, storage, WC, pump room for septic tank	No change
	Septic tank building	One-story, 58.4 m^2 Septic tank	No change
Total		4,969.78 m^2	No change

Source: The Ex-ante Evaluation Sheet p2, Preparatory Survey Report p46, Project Monitoring Report[20] (April 2019) (2-2 Scope of Work), Questionnaire to the NMIMR

The main changes from the outline design study (O/D) or detailed design study (D/D) are the removal of the storage, the addition of one BSL-3 laboratory room, the change in the position of the maintenance door, layout changes in some offices and laboratories, the change in the planned PCR area, the change of the machine room, the property room moving to an empty space, and the function change from the storage room to the second serological examination room (dark room).[21] The storage loss is the result of the need for budgetary adjustments to have two BSL-3 laboratories at the request of the NMIMR.[22] The reasons for the changes (other than the storage) were area reduction due to more detailed calculations and adjustments, efficiency and procedure optimization, and layout improvement for further safety enhancement.[23] All of these were in line with the NMIMR's requests and were made based on consensus, for which no problems were observed.

[20] Regarding the projects approved by the cabinet from November 2015 onwards, the final version of the project monitoring report will replace the project completion report (JICA).
[21] Project Monitoring Report (2-2 Scope of Work)
[22] Interview with the NMIMR
[23] Questionnaire to the implementing consultant

(2) Equipment

Equipment procurement was carried out almost as planned (Table 4). Table 4 shows the major changes from the O/D or D/D Studies.

Table 4 Equipment Procurement Plans and Results

	Plan	Results
Research Equipment	**BSL-3 Laboratory:** Formaldehyde decontamination unit, autoclave (A), deep freezer (-80°C), refrigerated centrifuge, inverted microscope, CO_2 incubator, etc.	No change
	Virology dept.: Deep freezer (-80°C), inverted microscope, autoclave (B), biosafety cabinet, centrifuge (various types), fluorescent microscope, flow cytometry (A), etc.	One microplate reader was added, and one fluorescent microscope was removed.
	Bacteriology dept.: Freezer (-20°C), refrigerated microcentrifuge, CO_2 incubator, deep freezer (-80°C), refrigerated centrifuge (B), biosafety cabinet, fluorescent microscope, etc.	Three pieces of equipment, such as autoclave were added, while technical specification of three pieces of Shaker incubator were revised.
	Immunology dept.: Deep freezer (-80°C), medical refrigerator, refrigerated microcentrifuge, clean bench, fluorescent microscope, ELISpot reader, flow cytometry (B), etc.	Four pieces of equipment, such as CO_2 incubators, were added, while technical specifications of three pieces of equipment, such as the microplate washer, were revised.
	Common molecular biology laboratory: Clean bench, PCR workstation, thermal cycler, real-time PCR, electrophoresis apparatus, gel imaging system, etc.	One refrigerator/freezer was added, while two pieces of equipment, such as the PCR workstation, were removed.
	Washing room: Autoclave (B), ice maker, dry hot oven, water distiller, etc.	No change

Source: Preparatory Survey Report p46, Project Monitoring Report (Attachment 5)

(3) Consulting services

The D/D Survey and construction/procurement management were implemented as planned.[24]

(4) Capacity building program (soft component)

Training for maintenance staff was conducted for technical guidance on BSL-3 laboratory equipment. The training was conducted three times, and eight trainees attended (three staff in charge of electricity, three in charge of air conditioning, two in charge of water supply and drainage) as planned. The objectives of the soft component related to proficiency were also achieved (Table 5).

[24] The Ex-ante Evaluation Sheet p2, Project Monitoring Report (2-3 Implementing Schedule)

Table 5 The Plan and Results of Soft Components

	Plan	Result
Objective	Properly Operating and Managing the BSL-3 Laboratory Facility Organization	Very well achieved[25]
Outputs	1. Understanding the BSL-3 Laboratory Facility System	- ditto -
	2. Mastering the operation of BSL-3 Laboratory Facility System	- ditto -
	3. Maintenance management of BSL-3 Laboratory Facility System	- ditto -
	4. Understanding the summary of biosafety	- ditto -
	5. Acquiring skills for formaldehyde fumigation	- ditto -
	6. Acquiring skills for the High Efficiency Particulate Air Filter (HEPA) filter replacement	- ditto -

Source: Preparatory Survey Report p126, Project Monitoring Report (2-2 Scope of work), Questionnaire to the NMIMR
Note: In the Japanese version of the Preparatory Survey Report, the expression of the objective is described as "The equipment and system of BSL-3 Laboratory facilities are appropriately operated, maintained, and managed".

In light of the above, the outputs on the Japanese side were achieved almost as planned.

3.2.1.2 Ghanaian Side

All of the items borne by the Ghanaian side were implemented as follows, although some were delayed. Plan 5 was delayed mainly due to the estimation and approval of preliminary expenses associated with changes in the tax exemption system.[26]

Table 6 Plans and Results of Items Borne by Ghanaian Side

No.	Plan	Result
1	To perform construction (construction except for the planned site, tree planting, installation of telephones, installation of equipment for a PC network and wiring work, high-voltage incoming line to the building's main circuit breaker, transfer of existing equipment, etc.) and to adjust the design for which the Ghanaian side is responsible	Implemented as planned and scheduled
2	To fully exempt tax for the project	- ditto -
3	To apply and acquire necessary permission for planning and construction.	- ditto -
4	To issue a banking arrangement (B/A) and authorization to pay (A/P) and to bear associated transaction fees	- ditto -
5	To grant a quick landing, tax exemption and custom operation for the equipment at the port of arrival and prompt domestic transport	Implemented though delayed
6	To arrange necessary entry and stay for the Japanese staff delivering the equipment and executing the project in accordance with the ratified contract	Implemented as planned and scheduled
7	To give full exemption from domestic customs and tax for the Japanese staff delivering equipment and executing the project in accordance with the ratified contract	- ditto -

[25] In a questionnaire sent to the NMIMR, it was asked to rate degree of achievement on a scale of 5 (5 being the highest), and the answer was 5.
[26] Interview with the NMIMR

8	To act for securing the budget for effective operation and maintenance management of the constructed facilities and procured equipment by grant aid	- ditto -
9	To install electricity, water, sewage line, and phone main line until the branch point	- ditto -
10	To transfer and install the existing equipment assigned for the project	- ditto -
11	To procure and install equipment that is not included in Japan's responsibilities	- ditto -
12	To purchase and install laboratory equipment, except for laboratory benches, and necessary office furniture	- ditto -
13	The Ministry of Education of Ghana takes necessary measures to ensure that Japanese juridical persons, Japanese nationals, construction materials, and equipment related to the project are exempt from various duties and taxes.	- ditto -

Source: Preparatory Survey Report p116-p120, Questionnaire to the NMIMR, Questionnaire to the Contractor

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost on the Japanese side was within the plan, i.e., 2,182 million yen (95% of the planned 2,285 million yen).

3.2.2.2 Project Period

The project period was from May 2016 to March 2019 (2 years and 11 months—35 months), and exceeded the planned period by 27 months (130% of the plan). This was due to delays in handover of the site, import customs clearance, and additional period for estimation and approval of preliminary expenses associated with changes in the tax exemption system.[27]

The outputs of this project were mostly achieved as planned. As for inputs, although the project period exceeded the plan, the project cost on the Japanese side was within the plan. Therefore, efficiency of the project is high.

3.3 Effectiveness and Impact[28] (Rating: ③)

3.3.1 Effectiveness

The purpose of this project was to improve the NMIMR's functions as a research, testing and educational institution by constructing the ARC. A comparison was made between the plan and the results at the time of the ex-post evaluation, focusing on the quantitative and qualitative effects expected at the time of planning.

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 7 shows the indicators of the quantitative effects and achievement status. Since there is no data for 2022, the data for 2021 was utilized, and data for 2019 and 2020 were obtained.

[27] Interview with the NMIMR, Project Monitoring Report (2-3 Implementing Schedule), questionnaire for the contractor

[28] When providing the sub-rating, effectiveness and impacts are to be considered together.

Table 7 Operation and Effect Indicators for Quantitative Effects

No.	Indicator	Baseline Value (2014)	Target value (2021) (3 Years After Completion)		Target Value (2019) (Completion Year)	Target Value (2020) (1 Year After Completion)	Target Value (2021) (2 Years After Completion)
1	Total number of research projects* at the three departments (Virology, Bacteriology, Immunology) (cases)	31	**36**	Total	**82**	**96**	**107**
2	Total number of interns within the three departments (Virology, Bacteriology, Immunology) (persons)	103.7 (Average for 2012 – 2014)	**135**	Total	**278**	**381**	**659**
				Male	120	166	286
				Female	158	215	373
3	The percentage of foreign student Interns (%)	9.3 (Average for 2012 – 2014)	**12**	Total	**9.55**	**10.9**	**11.4**
				Male	37.5	43.5	40.8
				Female	62.5	56.5	59.2
4	The number of times people accessed the BSL-3 Laboratory per year (persons)	1,005	**1,307**	Total	**1,329**	**3,808**	**6,411**
				Male	1,307	3,064	5,545
				Female	22	744	866

Source: The Ex-ante Evaluation Sheet p3, Questionnaire to the NMIMR

Note: * The projects acknowledged by the NMIMR and the data entered into the database of the Statistics Department.

The four indicators set at the time of planning were achieved except for the ratio of foreign interns, and greatly exceeded the target values. At the time of the ex-post evaluation, the actual achievement of Indicator 1 in Table 7 was 297% of the target, Indicator 2 was 488%, and Indicator 4 was 490%, which showed remarkable increase. The ratio of foreigners among interns in Indicator 3, which was slightly below the target, was 95%, with an achievement level that was still high. The reason for the non-achievement was the decrease in the number of intern participants due to the COVID-19 pandemic.

In terms of the number of interns accepted and the ratio of foreigners, women outnumber men. On the other hand, the number of BSL-3 laboratory users has overwhelmingly few women.

This is because there are few female applicants,[29] and the interns are selected regardless of gender. The NMIMR and the University of Ghana, with which the NMIMR is affiliated, have fostered an organizational culture in which personnel decisions are made based on ability regardless of gender, and there are many female staff and researchers in important positions.[30] Thus, there is no disadvantage due to gender regarding beneficiaries' benefits. Based on the above, the quantitative effects were mostly achieved.

3.3.1.2 Qualitative Effects (Other Effects)

Table 8 shows the three qualitative effects expected at the time of planning and the situation at the time of the ex-post evaluation.

Table 8 Qualitative Effects Compared to the Time of Planning (2015)

	Year			Reason/Causes
	2019	2020	2021	
1 Improvement in research quality conducted by the virology, bacteriology and immunology departments	5	5	5	- The quality of research has improved, and the publication of research papers has increased. The number of research papers has also increased in all three target departments (changes in the number of papers are shown in Table 9).
2 Increase in safety levels at the new BSL-3 laboratory	5	5	5	- No accidents have occurred so far. - Improved facilities and more attentive staff have contributed.
3 Increase in efficiency and accuracy of research through the introduction of the Molecular Biology Common Laboratory	4	4	4	- The work flow was made more efficient by improving the facility (larger space, more accurate equipment, and two sets of safety cabinets). - The equipment used in common by the three target departments was put together as a joint laboratory and separated from other laboratories. This helped improve the efficiency of experiments and prevent contamination.

Source: Questionnaire to and interview with the NMIMR

Notes: 5 *Significantly improved,* 4 *Improved,* 3 *Neither improved nor aggravated,* 2 *Aggravated,* 1 *Significantly aggravated*

The implementing agency recognizes that this project has improved the quality of research in the three target departments, the safety of the BSL-3 laboratories, and the efficiency and accuracy of experiments due to the opening of the molecular biology laboratories. Therefore, the expected qualitative effects have emerged.

Regarding the number of research projects, the number of papers in the three target departments has shown an increasing trend since the completion of this project, as shown in Table 9.

[29] Interview with the NMIMR

[30] At the time of the Ex-post Evaluation, the president, vice-president, and Director of the NMIMR were women, and many of the leaders of the NMIMR researchers were also women, according to an interview with the NMIMR.

Table 9 The Number of Research Papers in the Three Target Departments

(Unit: cases)

	2019	2020	2021
Virology Department	12	11	21
Immunology Departments	20	32	37
Bacteriology Departments	22	26	62

Source: Questionnaire to and Interview with the NMIMR

3.3.2 Impacts

3.3.2.1 Intended Impacts

At the time of planning, this project was expected to contribute to strengthening the capacity to respond to infectious diseases in Ghana and West Africa as a whole[31] as its impacts.

(1) Quantitative Effects

Not applicable.

(2) Qualitative Effects

Table 10 shows the contribution of this project as a hub for infectious disease control in Ghana and West Africa (diagnosis of existing and new infectious diseases[32], surveillance, etc.) at the time of the ex-post evaluation. The contribution status in all aspects is recognized as very high. A common factor for the improvement in the degree of contribution is the construction of the ARC under this project. Regarding the fostering of young researchers, that the expansion of laboratory space made it possible to train more young researchers and students.[33]

[31] The Ex-ante Evaluation Sheet p2

[32] Existing infectious diseases mean the emergence of which are already confirmed in the country, while new infectious diseases mean the emergence of which are newly confirmed.

[33] Questionnaire to NMIMR

Table 10 Contribution to Infectious Disease Control in Ghana and West Africa

		Status at the time of the Ex-post Evaluation	
		Ghana	West Africa
1	Contribution of the NMIMR as a hub of infectious disease surveillance	5	5
2	Contribution of the NMIMR as a hub of diagnosing existing infectious diseases	5	5
3	Contribution of the NMIMR as a hub of diagnosing new infectious diseases	5	5
4	Contribution to fostering young researchers in the field of infectious diseases (research, training)	5	5

Source: Questionnaire to the NMIMR

Note: 5 *Significantly increased/highest* —— 1 *Significantly decreased/lowest*

Polio is taken as a major example of the existing infectious diseases diagnosed by the NMIMR in Ghana and West Africa, and viral haemorrhagic fever is cited as an example of new infectious disease. Comparing the numbers before and after the implementation of this project, polio increased significantly by 2.6 times in Ghana and by 3.7 times in West Africa (Table 11). The number of diagnoses for viral haemorrhagic fever increased significantly by 4.0 times in Ghana, although there were no data for West Africa (Table 12).

Table 11 Number of Polio Diagnoses by the NMIMR

	2015	2021	Increase / Decrease
Ghana	719	1,892	263%
West Africa	1,265	4,704	371%

Source: NMIMR

Table 12 Number of Cases of Viral Haemorrhagic Fever Diagnosed by the NMIMR

	2015	2021	Increase / Decrease
Ghana	996	4,022	403%
West Africa	N/A	N/A	N/A

Source: NMIMR

Regarding the implementation status of training for young researchers in the field of infectious diseases in Ghana and West Africa, the NMIMR trained 299 young Ghanaian researchers and 15 young West African researchers in 2021. Data on training conducted before the project was unavailable (Table 13).

Table 13 Number of Participants in Training for Young Researchers at the NMIMR

(Unit: persons)

	2015	2021	Increase / Decrease
Ghana	N/A	299	N/A
West Africa	N/A	15	N/A

Source: NMIMR

Column: The Positioning of This Project in the COVID-19 Crisis

In March 2020, Ghana confirmed its first case of COVID-19—one year after March 2019, when the ARC was completed by this project.

At that time, the NMIMR was the only institution in Ghana that could conduct PCR tests for COVID-19, and it conducted 80% of the tests in Ghana in the early stages of the spread of infection. It conducted 350,579 PCR tests in 2020 and 152,009 in 2021.[34] A major factor that made this possible was the construction of the ARC under this project, which provided two new BSL-3 laboratories and equipment. This has made it possible for many technicians to perform a large number of PCR tests simultaneously using the latest facilities and equipment. Due to the urgent need to respond to a large number of cases, a large number of staff was hired in a short period of time, and inspections were conducted 24 hours a day under a shift system. The staff of the NMIMR responded to this by staying overnight.

In addition, the NMIMR collaborated with the Ministry of Health and the Ghana Health Service (GHS) to provide training on COVID-19 testing for domestic laboratories. As mentioned above, when the COVID-19 crisis broke out in Ghana, the NMIMR had the only laboratory that could perform PCR tests. In order to meet the growing need for testing, the NMIMR provided training to 56 domestic laboratories,[35] greatly contributing to the increase in the number of laboratories capable of PCR testing.

In addition to PCR testing, the NMIMR has contributed to the control of infectious diseases in Ghana through genetic analysis, surveillance, and other means. Furthermore, the NMIMR conducted training on methods for testing and analysis for laboratory technicians from neighbouring countries.[36] This contributed to strengthening the capacity of neighbouring countries to respond to COVID-19.

In this way, this project has significantly contributed to the NMIMR's testing, surveillance, and training in the fight against COVID-19. At the same time, it is noteworthy that the NMIMR's high-quality research and testing capacity made this contribution possible. The NMIMR made full use of state-of-the-art facilities and equipment, and the Ghanaian

[34] Questionnaire to NMIMR
[35] National Strategic COVID-19 Response Plan (2020 - 2024) p14, Interview with NMIMR
[36] Questionnaire to JICA Ghana Office

government and the NMIMR promptly made decisions and responded. The NMIMR staff also showed sincerity in crisis response.

Based on the above, the NMIMR's contribution as a hub of infectious disease control in Ghana and West Africa is high.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

At the time of planning, this project was classified as Category C based on "the JICA Guidelines for the Confirmation of Environmental and Social Consideration" (2010),[37] as the negative environmental impact of this project was assessed as minimal. An environmental impact survey appears to have been conducted prior to project implementation, but no records of the survey could be obtained. No negative impacts on the environment were confirmed even after project completion.[38]

(2) Resettlement and Land Acquisition

This project consisted of the construction of facilities on the premises of the NMIMR, and no land acquisition or resettlement was planned. It did not occur during its implementation.[39]

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

At the time of planning, these specific impacts were not assumed, and no significant impact by the implementation was confirmed.[40]

(4) Unintended Positive/Negative Impacts

The three indicators in Table 14 measure the strengthening of the functions of the NMIMR's nine research departments as a whole. In this project, it was aimed to construct the ARC including a new BSL-3 laboratory on the premises of the NMIMR and to procure research equipment. After completion, it was planned to relocate the three departments of virology, immunology, and bacteriology to the ARC. Meanwhile, the other six research departments and administrative departments aimed to expand the respective departments and to strengthen their functions through continuous usage of the existing NMIMR facilities and the vacant rooms which used to be utilized by the three departments. The NMIMR planned to renovate the existing BSL-3 laboratory partially and to use it as a training facility for BSL-2 and BSL-3 level experimental

[37] The Ex-ante Evaluation Sheet p2
[38] Questionnaire to and Interview with the NMIMR
[39] Questionnaire to the NMIMR
[40] Questionnaire to the NMIMR

and maintenance techniques. In addition to the implementation of this project, the quantitative indicators shown in Table 14 were set as the impacts to be achieved on the NMIMR side through the implementation of the above plan, including the renovation of the BSL-3 laboratory.[41]

Table 14 Expected Impact on the NMIMR as a Whole

Indicator	Unit	Baseline		Target Value (2021) 3 Years After Completion	Actual Value (2021)
		Baseline Year	Value		
Total number of research projects conducted at the whole NMIMR	cases	2014	88	101	107
Increase in Research Project Overhead	Ghana Cedi	Average of 2012 – 2014	1,595,120	2,074,000	3,720,000
Number of diseases the NMIMR recognizes as a national/regional reference centre	Number of diseases	2014	4 (TB, buruli ulcer, polio, influenza)	5	9*

Source: Preparatory Survey Report p147, Questionnaire to the NMIMR
Notes: *The NMIMR's reference laboratories at the time of the ex-post evaluation are as follows: TB, buruli ulcer, polio, influenza, HIV, yellow fever, haemorrhagic fever, rotavirus, COVID-19

As mentioned above, all three impacts on the NMIMR as a whole, which were expected to be achieved at the time of planning, have achieved their target values. In addition, the renovation of the existing BSL-3 laboratory, which was planned as a task on the NMIMR side, was carried out as planned.[42]

Based on the above, the expected quantitative and qualitative effects have emerged. As a hub of infectious disease control in Ghana and West Africa, the NMIMR has contributed highly, and other positive impacts have also emerged. Therefore, effectiveness and impacts of the project are high.

[41] Preparatory Survey Report, p vi, p147
[42] Questionnaire to the NMIMR

Column: Positioning of this project in the continuity of past multiple aid projects

The WAHO has stated that the ARC built at the NMIMR under this project is an asset not only for Ghana but also for West Africa.[43] In addition, the contribution of the NMIMR to the COVID-19 crisis has attracted international attention, as the prime minister of Japan mentioned at the United Nations General Assembly.[44] On the other hand, the advanced capacities of the NMIMR, which make full use of the state-of-the-art facilities and equipment developed through this project for research, testing, and training, is the result of JICA's long-term cooperation came to fruition.

Since the establishment of the NMIMR with Japanese assistance in 1979, Japan has provided various types of support for capacity building through grant aid and technical cooperation. Major examples are shown in Table 15.

Table 15 Examples of JICA Projects for the NMIMR

Names of Projects	Scheme	Duration
Project for Medical Cooperation to Medical School, University of Ghana	TC	1969 – 1973
- ditto – (Phase 2, Phase 3, and Phase 4)	TC	1973 – 1985
Postgraduate Medical Research Institute, University of Ghana Medical School	GA	1977 – 1978
Noguchi Memorial Institute Project Phase I	TC	1986 – 1991
Noguchi Memorial Institute Project Phase II	TC	1991 – 1997
The Project for the Improvement of the Noguchi Memorial Institute for Medical Research (Phases 1 & 2)	GA	1998
The Follow-up Survey and Follow-up Cooperation for the Project for the Improvement of Noguchi Memorial Institute for Medical Research	GA	2017 – 2018
The Infectious Disease Project at Noguchi Memorial Institute for Medical Research in Ghana	TC	1999 – 2003
West African Centre for International Parasite Control (WACIPAC) Project	TC	2004 – 2008
Studies of Anti-viral and Anti-parasitic Compounds from Selected Ghanaian Medicinal Plants	TC	2010 – 2015
The Project for Surveillance and Laboratory Support for Emerging Pathogens of Public Health Importance	TC	2016 – 2021
Partnership for Building Resilience against Public Health Emergencies through Advanced Research and Education（PREPARE）	LT	2018 -
Project for the Improvement of Safety and Quality Management Systems in Noguchi Memorial Institute for Medical Research	TC	2022 – 2025

Source: Formulated by the evaluator based on the Preparatory Survey Report p9-p11, JICA web page "Visualising ODA," etc.

Note: TC: Technical Cooperation, GA: Grant Aid Cooperation, LT: Long-term Training

This cooperative project relates to highly advanced facilities and equipment and is positioned as an extension of the above assistance. In addition, this project was possible and

[43] Interview with the NMIMR

[44] Speech by Prime Minister Suga at the 75th United Nations General Assembly (September 25, 2020). https://www.israel.emb-japan.go.jp/itpr_en/souri_20200925.html

effective as a result of the combination of various projects and long-term, continuous capacity building, rather than owing to a specific project.

Specifically, the factors which contributed to the capacity enhancement of the researchers included the combination of both hard aspects such as facility construction and soft aspects such as technical cooperation. Among the soft aspects, multifaceted capacity development was intended through various schemes such as technical cooperation projects, SATREPS, various types of training in Japan (omitted in Table 15), long-term degree programs. Furthermore, the succession and continuation of this support led to sustaining the mutual understanding and trusting relationship between the NMIMR and the JICA office.[45]

Japanese who visit the NMIMR will be deeply impressed by the staff's sincere attitude toward work, their politeness, and consideration for others. The NMIMR has many participants in training in Japan, and some people point out the impact of this.[46] While interacting with Japanese organizations and Japanese people in general, including Japanese researchers, university and JICA staff, and others, many researchers have acquired a sincere work ethic. In addition to JICA's training in Japan, collaboration with researchers from Japan and overseas countries other than JICA has also provided a positive impact on values and work ethic. These have led to the NMIMR's unique organizational culture and an improvement in the quality of research and training, together with knowledge and equipment.

JICA's long-term support for the NMIMR through a variety of schemes is a good practice. The long-term, multifaceted support for an organization which plays an important role in partner countries and has excellent potential will bring significant positive effects not only to the partner country but also to the region.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

Ghana's *National Medium-Term Development Policy Framework (2022-2025)* and *Ghana Roadmap for Achieving Universal Health Coverage 2020-2030* both aim to reduce infectious diseases. Significant changes are not likely after the ex-post evaluation. In addition, the policy goals of *HSMTDP 2022-2025* include "universal access to better and more efficiently managed quality health services" and "improved access to rapid emergency services in clinical and public health". Furthermore, in relation to the latter, the establishment and strengthening of the "Ghana Center for Disease Control" (Ghana CDC)[47] are advocated. Therefore, there are no issues regarding future policy and system prospects.

[45] Interview with the NMIMR
[46] Interview with the NMIMR
[47] Regarding Ghana CDC, please refer to p18.

3.4.2 Institutional/Organizational Aspect

At the time of planning, the NMIMR was a research institute belonging to the University of Ghana's "Health College", the largest and most excellent public university in Ghana, and had nine research departments. It was a semi-autonomous organization, which adopted a self-supporting accounting system except for staff salary. The NMIMR had four main roles: 1) research and surveys, 2) function of the disease control centre, 3) special testing and diagnosis, and 4) fostering researchers.[48] Even at the time of the ex-post evaluation, the position, function, and purpose of the NMIMR have not changed.[49]

Table 16 shows the changes in the number of employees in the three departments targeted by this project.

Table 16 Personnel in the Three Target Departments

(Unit: persons)

	2015 (Actual)	2018	2019	2020	2021	2022 (not yet completed)	2023 (Plan)
Department Head, Professor	5	5	5	5	5	5	10
Researcher	16	14	18	22	23	23	28
Assistant Researcher, Engineer	66	75	82	158	181	178	158
Others (Office Clerk, etc.)	9	8	8	8	8	9	8
Total	96	102	113	193	217	215	204

Source: Preparatory Survey Report p132, Questionnaire to the NMIMR
Note: The number of the maintenance staff is not included.

At the time of the ex-post evaluation, the total number of people in the three target departments was more than double that before the project was implemented, and the increase in the number of researchers, research assistants, and technicians is remarkable. The number of research assistants and technicians increased significantly in 2021 and decreased in 2022. This is due to a temporary increase in personnel to deal with the enormous amount of PCR testing due to the COVID-19 pandemic. The government of Ghana has approved an unusually large increase in the number of NMIMR staff members by 45 in FY2022. It is said that this is because the government recognized the NMIMR's contribution to the fight against COVID-19. Of these, 41 staff were already hired and started working by the end of December 2022. In addition, five engineers (mechanical, electronic, and biomedical fields) were assigned as facility maintenance personnel by the end of December 2022.

[48] Preparatory Survey Report p13-p17
[49] Questionnaire to NMIMR

Table 17 shows the facility maintenance personnel responsible for the maintenance and management of the NMIMR facilities and equipment as a whole.

Table 17 Number of Maintenance Staff in the NMIMR

(Unit: person)

	2015	2021	2022
Staff who received Bio-safety Training	4	8	8
Those who received the training in the Soft Component of this project	0	8	8
Others	4	0	0
Staff who have not received Bio-safety Training	7	0	5
Total	11	8	13

Source: Preparatory Survey Report (Attachment-5), Questionnaire to NMIMR

The number of maintenance personnel was 11 at the time of planning, and it had been already decided that three of them would retire in two years, and it was pointed out that it was essential to supplement personnel.[50] At the time of the second field survey of this ex-post evaluation (September 2022), the NMIMR had eight maintenance personnel. The NMIMR had been negotiating with the government to secure personnel to replace the three retired workers, but because it generally takes time to secure replacements in Ghana, no replacements had been made at the time of the ex-post evaluation. Of the eight maintenance staff, two are in charge of the ARC, including the operation and maintenance of the BSL-3 laboratory. They sometimes work on weekends due to a manpower shortage. However, as the engineers mentioned above are hired, the problem is expected to be resolved.

As mentioned in 3.4.1, *HSMTDP 2022-2025* calls for the establishment and strengthening of the Ghana CDC. The Ghana CDC is an organization that serves as a central coordination point for all relevant agencies in the event of a public health emergency. The preparation of establishment has been advanced by the initiative of the World Bank, after its necessity was recognized during the outbreak of Ebola haemorrhagic fever. After the establishment of the Ghana CDC, the NMIMR is expected to play a role as a member of the CDC Advisory Committee in strengthening the capacity of medical research and related laboratories.[51] Thus, it is likely that NMIMR plays a further important role in the event of public health emergency after its establishment. Therefore, sustainability from the aspects of organization and system is high.

3.4.3 Technical Aspect

At the time of planning, NMIMR was considered the highest-ranking research institute in Ghana with a BSL-3 laboratory,[52] and it was officially accredited by the World Health

[50] Preparatory Survey Report p125
[51] Interview with World Bank
[52] Preparatory Survey Report p24

Organization (WHO) as an infectious disease surveillance agency.[53] Even at the time of the ex-post evaluation, the capacities of NMIMR researchers were highly evaluated. The NMIMR has researchers with diverse specialties, is internationally recognized, and serves as a member of many committees in both Ghana and abroad. Their papers have been published in high-impact journals and have been awarded highly competitive research grants. However, this does not apply to technicians, and training is required.[54]

Because almost all of the facilities and equipment for research experiments that were provided are functioning, no problems have been observed with regard to overall maintenance capacity.[55] According to the NMIMR, procurement of spare parts for the equipment has been made in a timely manner, and it has been assessed that there are no problems.

Reliable retention of high-risk pathogens by HEPA filters is mandatory in BSL-3 laboratories. On the other hand, in the existing BSL-3 laboratory, the HEPA filter, which should be replaced every two years, had not been replaced for ten years.[56] In this project, the soft component was used to improve the knowledge and skills of the maintenance staff regarding the operation and maintenance of the BSL-3 laboratory, and all of the eight trainees remained working even at the time of the ex-post evaluation. Thus, it has been determined that the knowledge and skills are maintained.

The HEPA filter in the BSL-3 laboratory has not yet been replaced even at the time of the ex-post evaluation. As the timing of the HEPA filter replacement depends on the frequency of use, it is scheduled to be replaced as soon as the red signal lights up, and there is no problem with that point itself. However, at the time of the ex-post evaluation, none of the maintenance personnel who received training in the soft component had official qualifications to replace HEPA filters. Because it would be illegal for unqualified personnel to replace them, the NMIMR cannot replace HEPA filters.[57] For this reason, it is necessary to have maintenance personnel acquire this qualification within two to three years when HEPA filter replacement is expected to become necessary. The NMIMR is aware of this problem and intends to address it.[58]

As a lesson learned from similar projects in the past, it was indicated at the planning stage that this project should encourage the proactive participation of Ghanaian stakeholders in the selection of equipment, as well as select materials and equipment that match the purpose of constructing the ARC, the technical level of users, and the environment for procurement of spare parts.[59] During the planning of this project, the NMIMR, JICA, and the implementation consultant repeatedly discussed not only spare parts but also facilities and equipment as a whole.

[53] The Ex-ante Evaluation Sheet p2
[54] Questionnaire to and interview with NMIMR
[55] Questionnaire to and interview with NMIMR, site observation
[56] Preparatory Survey Report p125
[57] Interview with NMIMR. The name of the qualification is Biosafety Cabinet Certification and Technology Certificate. The certificate is issued by Eagleson Institute.
[58] Interview with NMIMR
[59] The Ex-ante Evaluation Sheet p3

It is believed that this led to the clarification and sharing of needs, which in turn contributed to the good maintenance and management of the facilities. In light of the above, slight issues have been observed regarding the technical aspect.

3.4.4 Financial Aspect

The NMIMR has its own revenues (project indirect costs, testing revenues, experimental animal sales, interest, etc.) and research project budgets funded by other donors and research institutes. It was expected to generate more revenue from more advanced research and special diagnostics for infectious diseases after the ARC starts it operation.[60] Table 18 shows the income and expenditure status of the NMIMR before and after this project. At the time of the ex-post evaluation, income and expenditure increased to 135% and 139%, respectively, compared to before the start of the project. Thus, there are no financial issues.

Table 18 Income and Expenditure Status of NMIMR

(Unit: Thousand Ghana Cedi)

Item	2015	2016	2017	2018	2019	2020	2021
Income							
Governemtn Budget (staff salary)	7,639	7,704	9,641	10,706	11,088	11,213	15,012
Internal Income	3,877	3,038	5,324	4,453	5,575	5,452	7,967
Grant Income	22,127	20,502	22,962	21,484	19,912	32,037	54,697
Total Income (A)	**33,643**	**31,245**	**37,927**	**36,643**	**36,576**	**48,702**	**77,676**
Yen equivalent (Thousand JPY)	*1,076,578*	*867,905*	*953,901*	*832,799*	*650,697*	*866,436*	*1,463,655*
Expenditure							
Staff salary	7,639	7,704	9,641	10,706	11,088	11,213	15,012
Management Expenses	867	964	1,094	1,215	1,255	3,411	1,964
Utilities	218	159	226	273	276	429	365
Building Maintenance	200	344	335	276	248	657	431
Facilities, A/C, Vehicle Maintenance	317	254	253	214	326	177	334
Equipment Maintenance	682	737	319	381	720	422	455
Facility Investment	495	21	1,149	42	42	127	296
Project Expenditure	19,914	19,477	20,666	20,410	18,319	27,232	53,056
Total Expenditure (B)	**30,332**	**29,661**	**33,683**	**33,517**	**32,274**	**43,667**	**71,913**
Yen Equivalent (Thausand JPY)	*970,612*	*823,920*	*847,155*	*761,739*	*622,810*	*776,847*	*1,355,066*
Balance							
Balance (A-B)	**3,311**	**1,583**	**4,244**	**3,127**	**4,302**	**5,036**	**5,763**
Yen Equivalent (Thousand JPY)	*105,967*	*43,985*	*106,746*	*71,060*	*83,012*	*89,589*	*108,588*

Source: NMIMR

In addition, the ARC's maintenance budget has increased both in terms of budget and expenditure since the project completion year, and it has remained in the black (Table 19). As mentioned above, the government of Ghana has approved a significant increase in the number of NMIMR staff in fiscal year 2022. And it has also approved a budget of 28 million Ghana

[60] Preparatory Survey Report p143

Cedis to support the ARC. This will be used for facility maintenance and equipment repair/renewal.[61]

Table 19 ARC Maintenance Budget

(Unit: Ghana Cedi)

	2019	2020	2021
Budget	1,061,000	1,053,790	1,100,000
Expenditure	742,000	899,000	1,033,758
Balance	319,000	154,790	66,242

Source: Questionnaire to NMIMR

Table 20 shows the commissioned research expenses out of the NMIMR's income. Research commissioned by international donors to the NMIMR generally continues to increase. As for research from the government of Ghana, the research contract fee decreased in FY2020 for the same reason.[62] However, at the time of the ex-post evaluation, the emergency response to the COVID-19 disaster had already passed its peak, and it is expected that the emphasis will be placed on research as before.[63]

Table 20 Commissioned Research Expenses of the NMIMR

(Unit: Thousand Ghana Cedi)

	2016	2017	2018	2019	2020	2021
International donors	20,502	22,962	21,484	19,912	32,037	54,697
Government fund	0	0	0	2,258	18,248	0
Others	0	0	0	0	0	0

Source: Questionnaire to and interview with NMIMR

3.4.5 Environmental and Social Aspect

As mentioned above, no negative impacts on the environment have been observed, and the possibility is considered to be low in the future.

3.4.6 Preventative Measures to Risks

Risks assumed at the time of planning included a lack of technical capacity for operation and maintenance, a lack of financial capacity for operation and maintenance, a shortage of bidders, and an insufficient capacity of contractors (including local subcontractors).[64] However, no

[61] Interview with NMIMR
[62] Questionnaire to NMIMR
[63] Interview to NMIMR
[64] Project Monitoring Report (4 potential risks and mitigation measures), questionnaire to and interview with NMIMR

problems were observed during implementation and ex-post evaluation. Also, as mentioned earlier, there have been no accidents in the BSL-3 laboratory.[65]

3.4.7 Status of Operation and Maintenance

At the time of the ex-post evaluation, more than 96% of the equipment is functioning and being utilized. The only non-functioning one is the PCR machine, which has failed due to power outages and voltage fluctuations. The broken switchboard needs to be replaced, and the NMIMR has been conversing with a Japanese supplier. The large autoclave broke down in July 2020 but was repaired by the local agent in May 2021. During that time, another piece of the same equipment was utilized, so there were no major problems[66]. In addition, the operation and maintenance status of the BSL-3 laboratory was good, and no problems were observed. However, since there is no storage space, cardboard boxes are piled up here and there in the corridors and on the landings of the stairs, and there is concern that they will hinder use in an emergency.

From the perspective of improving sustainability, the implementing consultant considered the ease of maintenance during the planning stage, tried to use construction materials with specifications that could be procured locally, and exercised the ingenuity in reducing air-conditioning load to lower the maintenance cost. In addition, at that time, the implementing consultant involved those concerned at the NMIMR and had repeated discussions.

In light of the above, slight issues have been observed in the technical aspects. However, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

This project was intended to improve the research, testing and educational functions of the Noguchi Memorial Institute for Medical Research (hereinafter referred to as the NMIMR) by constructing the Advanced Research Center for Infectious Diseases (ARC), thereby contributing to strengthening the capacity to respond to infectious diseases in Ghana and West Africa as a whole. This project was in line with Ghana's development policy and development needs, as well as Japan's development cooperation policy at the time of planning, as it aimed to contribute to capacity strengthening of Ghana and West Africa to respond to infectious diseases, through improving the functions of the NMIMR. Synergies between this project, a Science and Technology Research Partnership for Sustainable Development (SATREPS) program, and the Third-country Training were anticipated at the time of planning, and synergies were observed

[65] Questionnaire to and interview with NMIMR
[66] Site observation and interview with the maintenance division of NMIMR

when these projects were implemented as planned. Although there has been no collaboration or coordination at the time of planning for projects other than JICA, training by other donors and research with Japanese universities were implemented at ARC due to coordination at the time of implementation, and mutual linkage was recognized. Therefore, its relevance and coherence are high. The outputs of this project were mostly achieved. Although the project period exceeded the plan, the project cost on the Japanese side was within the plan. Therefore, efficiency of the project is high. Regarding the project objective, i.e., improvement of the NMIMR's function, the indicators for both quantitative and qualitative effects have been achieved, and the expected impact has been realized. Therefore, effectiveness and impacts of the project are high. Slight issues have been observed in the technical aspect concerning the operation and maintenance of the project. However, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high. In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Acquisition of maintenance personnel's qualification required for HEPA filter replacement

Regarding the maintenance and management of the BSL-3 laboratories, it is hoped that NMIMR will take responsibility for ensuring that maintenance personnel acquire the necessary qualifications for HEPA filter replacement.

(2) Securing storage space

At the time of appraisal, at the request of the NMIMR, storage space was omitted in order to set up two BSL-3 laboratories. It is desired that NMIMR will secure storage space with the assistance of the Ghanaian government or with its own budget.

(3) Prompt repairment of PCR machine and securing UPS with AVR function

It is desired that NMIMR will promptly repair the PCR machine and secure Uninterrupted Power Supply system with Aautomatic Voltage Regulator function, if possible.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Maintenance conscious project plan and involvement of the executing agency

From the perspective of enhancing sustainability, the implementing consultant considered the ease of maintenance, tried to use construction materials with specifications that could be procured locally, and exercised the ingenuity in reducing air-conditioning load to make the operation and maintenance cost lower. In addition, at that time, people involved in the NMIMR,

the executing agency, were involved in repeated discussions. This was beneficial for good maintenance of the facility.

It is essential to use materials and equipment that can be procured locally and make the specifications easy to repair, involve local stakeholders during planning, hold repeated discussions, and make a plan that is easy for the executing agency to maintain and manage once it is put into service.

5. Non-Score Criteria

5.1. Performance

5.1.1 Objective Perspective

From the perspective of improving sustainability, the implementing consultant considered the ease of maintenance and tried to use locally procured construction materials. Various measures were taken to reduce the air-conditioning load, specifically by arranging equipment balconies around the outer wall of the building for the outdoor units of air conditioners and covering them with walls (partially louvered for daylighting and air-conditioning exhaust). The design was intended to avoid direct exposure to the strong sunlight peculiar to Africa on the outer wall of the rooms and to reduce the air-conditioning load considerably. In addition, natural ventilation in the attic was ensured to reduce solar radiation from the roof surface. In addition, there is a vast amount of expensive research equipment, and rain and water leaks are fatal, so piping that penetrates the floor and ceiling in the laboratory was avoided as much as possible, and piping was made through this equipment balcony. This makes it easier to inspect and troubleshoot. Except for some special laboratories, air conditioners were standard wall-mounted units (same as for general housing) to facilitate troubleshooting.[67]

In addition, the implementing consultant appropriately fulfilled the required roles in the preparation of tender documents, implementation of construction tenders, and construction management, and the JICA local office was very cooperative with the executing agency from the planning to the completion stage[68].

5.2. Additionality

None.

[67] Implementing consultant
[68] Questionnaire to NMIMR