Republic of Indonesia

FY2022 Ex-Post Evaluation Report of Japanese Grant Aid Project "The Project for Improvement of Equipment for Disaster Risk Management"

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0. Summary

This project was implemented to enhance the capacity for earthquake and tsunami analysis and to improve the accuracy of seismic source and seismic intensity analysis by providing seismic observation equipment to the Agency for Meteorology, Climatology and Geophysics (BMKG) and the Indonesian Institute of Sciences (LIPI, which was merged into the National Research and Innovation Agency (BRIN)[1] of Indonesia), which are the Indonesian seismic observation agency and research institution, respectively, thereby contributing to the enhancement of the country's disaster prevention capacity. This project, which is intended to strengthen the capacity for earthquake and tsunami analysis, is highly consistent with Indonesia's policy and development needs and aligned with Japan's ODA policy at the time of planning. Although the project and a technical cooperation (TC) project were intended to be linked at the time of planning, the commencement of the TC project was delayed until after the completion of this project due to the Palu earthquake and the COVID-19 pandemic. Therefore, there was no linkage between the two projects. Although there was no planned and coordinated linkage with the projects supported by other aid agencies, the project is consistent with the direction of the *Sendai Framework for Disaster Reduction 2015-2030*. Therefore, the project's relevance and coherence are high. The project outputs were mostly achieved as planned, and additional components were implemented with the residual funds. Although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, the project's efficiency is moderately low. The quantitative and qualitative effects of the project objective, i.e., the enhancement of capacity for earthquake and tsunami analysis, were mostly achieved. The project did not achieve the expected impact of improving the capacities of government agencies related to disaster prevention for disaster initial and emergency responses and restoration. However, some positive impacts emerged, such as enhancement of the accuracy of the UNESCO-led Indian Ocean Tsunami Warning and Mitigation System (hereinafter referred to as IOTWS) and utilization of some of the equipment provided to BRIN for undergraduate students' thesis guidance. Therefore,

[1] In Indonesian, it stands for "Badan Riset dan Inovasi Nasional." The National Research and Innovation Agency was established in 2020, integrating a number of research institutions, including the National Institute of Aeronautics and Space, the Indonesian Institute of Sciences (LIPI), the National Nuclear Energy Agency of Indonesia, and the Agency for the Assessment and Application of Technology, to conduct research necessary for national development. The purpose of the integration is to combine the research institutions' funds, infrastructure, and human resources to coordinate all government research programs properly. However, the location of the former LIPI (Bandung) and key personnel at that time remain unchanged at the time of ex-post evaluation. To avoid confusion, in this report, "LIPI" denotes the project from the time of planning to the time of implementation and "BRIN" the project after completion.

effectiveness and impacts of the project are high. Slight issues have been observed in the institutional/organizational, technical, financial aspects. 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. Project Description

Project location
(source: formulated by the evaluator based on the map JICA provided)

A seismic station constructed to install the seismic observation equipment
(source: a photo taken by the evaluator)

1.1 Background

Indonesia is an island nation formed along an oceanic trench and is prone to massive earthquakes, similar to the Japanese archipelago. It is also one of the countries in Southeast Asia where natural disasters occur most frequently. Natural disasters in Indonesia range widely, including earthquakes, landslides and slope failures, volcanic eruptions, floods, forest fires, wind storms, and tidal waves and storm surges. The country has numerous faults and one of the longest coastlines in the world, extending more than 50,000 km, and has frequently suffered from disasters such as earthquakes, volcanic eruptions, and large tsunamis caused by major earthquakes along the Pacific Coast. In particular, the region is prone to plate earthquakes, and because the ocean trench is located near the coast, the time between the occurrence of an earthquake and the arrival of a tsunami is short.

Whereas Indonesia enacted *the Disaster Management Law* after the 2004 Sumatra Earthquake, Japan enacted *the Act on Special Financial Assistance and Grants for Coping with the Great East Japan Earthquake* in response to the devastating damage the Great East Japan Earthquake caused in March 2011. Based on this, it was decided to implement “Japan's Grant Aid for Disaster Prevention and Reconstruction (Type I-D),” which procures disaster prevention equipment related to earthquake and tsunami for Indonesia. In October 2011, Japan conducted the “Data Collection Survey on Earthquake and Tsunami Observation Systems in Indonesia” to comprehend Indonesia’s situation and needs for earthquake and tsunami disaster prevention. Subsequently, the requests were summarized, which led to the implementation of the project. Under these circumstances, this project was required to include in the plan as much as possible the procurement of products that would contribute to the promotion of industries in the "specified disaster areas" defined by the Great East Japan Earthquake (products from the disaster areas) and to procure disaster prevention-related equipment, including advanced Japanese technology, as countermeasures against earthquakes and tsunamis. For this reason, it was mandatory that the equipment to be procured was made in Japan ("Japan-tide"), in principle.

1.2 Project Outline

The objective of this project is to enhance the country's capacity for earthquake and tsunami analysis and to improve the accuracy of seismic source and intensity analysis in Indonesia by providing seismic observation equipment to BMKG and LIPI, seismic observation and research institutes, respectively, thereby contributing to improving the country's disaster prevention capacity.

Grant Limit / Actual Grant Amount	1,500 million yen / 1,500 million yen
Exchange of Notes Date / Grant Agreement Date	March 2013 / November 2013
Executing Agencies	BMKG and LIPI
Project Completion	July 2019
Target Area	All over Indonesia
Main Contractors	Package 1: TEC International Inc. Package 2: NEC Corporation Package 3: TEC International Inc.
Main Consultant(s)	The consortium consisting of Oriental Consultants Global Co., Ltd. and Pacific Consultants Co., Ltd.
Procurement Agency	Japan International Cooperation System
Preparatory Survey	March 2012 - July 2014
Related Projects	**Technical Cooperation Project** - The Project for Enhancement of the Disaster Management Capacity of National Disaster Management Authority (BNPB) and Regional Disaster Management Authority (BPBD) (2011 - 2013) - Capacity Development on Operation of Earthquake and Tsunami Analysis and

	Warning Dissemination (2022 - 2025) - The Project for Enhancement of Disaster Risk Reduction through Improvement of the Disaster Risk and Communication Framework (2023 - 2026); **Other International Organizations, Donors, etc.** - Japan-Indonesia Seismic Network (JISNET) of National Research Institute for Earth Science and Disaster Resilience (NIED) (2001 - 2010)

2. Outline of the Evaluation Study

2.1 External Evaluator

Mayumi Hamada, Foundation for Advanced Studies on International Development

2.2 Duration of Evaluation Study

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

Duration of the Study: August 2022 - December 2023

Duration of the Field Study: January 15, 2023 - January 27, 2023

May 22, 2023 - May 30, 2023

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 Indonesia

At the time of planning, the National Disaster Management Agency (BNPB) developed *the National Disaster Risk Reduction Action Plan 2010-2012* to promote specific activities of *the National Disaster Management Plan 2010-2014*. The action plan's priorities include "strengthening risk identification, assessment, monitoring and early warning." In addition, *the BMKG's Medium-term Strategic Plan 2010-2014* called for the installation of 500 strong-motion seismographs.[4] At the implementation stage, *the National Disaster Management Plan 2015-2019* specified the roles of the 37 ministries and agencies involved in disaster management and set forth efforts to mainstream disaster management with the BNPB, the key organization. *The National Disaster Management Plan 2020-2024* also calls for a more robust earthquake information system and tsunami early warning and emphasizes increasing the population's response time as a tsunami preparedness and mitigation measure.[5] The action plan includes strengthening the integrated early

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ④: Very High, ③: High, ②: Moderately Low, ①: Low
[4] The Ex-ante Project Evaluation Sheet pp.1-2, Preparatory Survey Report pp.1-3
[5] Chapter 2 p.43

warning system and utilizing disaster prevention-related research, innovation, and technology through collaboration among multiple agencies.[6]

In addition, the Government of Indonesia has identified disaster management as one of the nine priorities in *the National Medium-Term Development Plan (RPJMN) 2015-2019.*[7] *The RPJMN 2020-2024* includes "improvement of the environment and capacity building for disaster reduction and climate response" as one of the seven development agendas.[8] In addition, *Presidential Decree No. 93 of 2019* sets forth the strengthening of the development of earthquake information systems and tsunami early warning systems, which is still valid at the time of ex-post evaluation. Therefore, the direction of the project to strengthen the country's capacity to prevent disasters, such as earthquakes and tsunamis, has been consistent with Indonesia's policy since the time of planning to the time of ex-post evaluation.

3.1.1.2 Consistency with the Development Needs of Indonesia

On the west side of Sumatra, Indonesia, the Indo-Australian Plate is subducting beneath the Eurasian Plate, and there is a reverse fault zone parallel to the island, which causes frequent large earthquakes. At the time of planning, the amount of seismic observation equipment in Indonesia was small compared to the national land area, and there were problems with the accuracy of seismic source analysis and magnitude estimation. Regarding tsunamis, there was insufficient reconciliation between simulation results and actual observed wave heights, and the number of tsunami simulation scenarios stored in the database was small. Therefore, it was not possible to estimate adequately the damage caused by tsunamis. In addition, some equipment in the existing warning systems was not functioning due to inadequate maintenance.[9] From the time of implementation to the time of the ex-post evaluation, there has been no particular change in the geological conditions related to the occurrence of earthquakes in Indonesia. In addition, Table 1 shows the number of earthquakes that caused more than 50 fatalities in Indonesia from 2000 to 2022.

[6] Chapter 3, p.82, Appendix pp.158-161

[7] The project was positioned as "Disaster Preparedness and Mitigation" in the area of "Natural Resources, Permanent Living Environment and Disaster Management" under "Realization of Economic Independence by Mobilizing Strategic Sectors in the Domestic Economy."

[8] The Information collection and verification study for disaster management in Indonesia p.1 of Summary

[9] The Ex-ante Project Evaluation Paper p.1

Table 1: Occurrence of Earthquakes in Indonesia
(with more than 50 fatalities from 2000 to 2022)

	Year	Month	Name	Number of Deaths (persons)
1	2000	APR	Major Earthquake off the Coast of Sumatra and Tsunami in the Indian Ocean (2000)	100
2	2004	DEC	Major Earthquake off the Coast of Sumatra and Tsunami in the Indian Ocean (2004)	220,000
3	2005	MAR	Major Earthquake off the Coast of Sumatra and Tsunami in the Indian Ocean (2005)	2,000
4	2009	SEP	Major Earthquake off the Coast of Sumatra and Tsunami in the Indian Ocean (2009)	1,100
5	2010	OCT	Major Earthquake off the Coast of Sumatra and Tsunami in the Indian Ocean (2010)	400
6	2018	AUG	Lombok Island Earthquake	460
7	2018	SEP	Palu Earthquake	4,340
8	2021	JAN	Mamuju Earthquake	90
9	2022	NOV	Cianjur Earthquake	327

Source: Preparatory Survey Report p1-1, BMKG Questionnaire
Note: As indicated in the subtitle (in parentheses), the above shows only the earthquakes in Indonesia since 2000 in which 50 or more people died.

Although the 2004 Sumatra earthquake stands out, casualties from earthquakes remains high from the time of planning through the time of ex-post evaluation. Therefore, the importance of accurate earthquake observation and prompt issuance of warnings remains high.

3.1.1.3 Appropriateness of the Project Plan and Approach

Sites for seismic stations were selected based on the location of nationwide observation stations of BMKG and seismic observation needs, and there was no unfair selection due to ethnic or other factors.[10] Moreover, Package 3 (real-time seismic observation system) and "Installation of IT seismic intensity meter and guidance on operation and maintenance" were implemented using the residual funds. Both were conducted based on the agreement with BMKG, and there was no problem with an addition to the scope. Furthermore, lessons learned from similar past projects revealed the existence of cases in which operation and maintenance management were not properly carried out although hardware support, such as a prewarning system, was provided. So, efforts were made to mitigate this risk through the collaboration between this project and the technical cooperation project. Details are described in the Sustainability section (3.4.6 Addressing Risks). Based on the above, there were no problems with the appropriateness of the project plan and approach.

[10] Questionnaire for BMKG

3.1.2 Coherence (Rating: ②)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of planning, the *Country Assistance Policy for Indonesia (2012)* included "Assistance for correction of inequality and establishment of a safe society" as a priority area, and this project was positioned within the "Disaster Reduction Capacity Improvement Program.[11]" Therefore, this project was in line with Japan's ODA policy at the time of planning.

3.1.2.2 Internal Coherence

At the time of planning, the project was planned and coordinated to improve seismic observation capacities as well as equipment maintenance and management systems through collaboration between the project and the "Capacity Development on Operation of Earthquake and Tsunami Analysis and Warning Dissemination" (TC project), taking advantage of lessons learned from the past.[12] However, the commencement of the TC project was postponed due to the BMKG's response to the Palu earthquake in Sulawesi and the COVID-19 disaster, which led to the modified project duration from February 2022 to February 2025.[13] As the TC project was postponed due to these external conditions, two years and seven months elapsed between the completion of this project in July 2019 and commencement of the TC project. Therefore, it cannot be said that the two projects were linked at the implementation stage. As for other JICA projects, there was no substantial concrete collaboration with the project.

3.1.2.3 External Coherence

At the time of planning and implementation of the project, there were no plans or coordination intended to produce specific effects by linkage between this project and projects supported by other Japanese organizations or international donors. Among 93 observation stations supported under this project for BMKG, equipment at 15 stations was installed under Japan-Indonesia Seismic Network (JISNET) support the NIED of Japan provided. This project was intended to upgrade the equipment at the JISNET sites, which were due for renewal.[14] However, because the above project was already completed before the start of this project, it cannot be said that there is external coherence between them. Regarding the consistency with international frameworks, the project is consistent with the direction of the Sendai Framework for Disaster Reduction 2015-2030, which was adopted at the Third World Conference on Disaster Reduction in 2015, which called for reduction of disaster risks and losses.[15]

[11] The Ex-ante Project Evaluation Paper p.2

[12] Questionnaire for and interview with BMKG

[13] Interviews with JICA experts of the above TC project and implementation consultant of this project. In addition, the record of discussions (R/D) of this project stipulates that the date the Japanese expert arrived in Indonesia was the project commencement date although the contract between JICA and the consultant started in 2020. Therefore, the commencement of this project was February 2022.

[14] Preparatory Survey Report p.3-2

[15] The Information collection and verification study for disaster management in Indonesia p.9 of Summary

From the planning stage to the post-evaluation stage, the project has been consistent with Indonesia's policy of strengthening disaster prevention and the development needs of the country, which is prone to earthquakes. There were no problems with the appropriateness of the project plan and approach. In addition, the project was consistent with Japan's ODA policy at the time of planning. Regarding internal consistency, although the project and the TC project were coordinated at the time of planning, the project started after the completion of the TC project due to the postponement of the TC project's start date. Therefore, the two projects were not linked. As for external consistency, no planned and coordinated linkage was found. On the other hand, the project is consistent with the direction of the "Sendai Framework for Disaster Reduction 2015-2030." Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

A) Japanese Side

1) Civil Works and Equipment Procurement

Table 2 shows the planned and actual outputs.[16] The project outputs were implemented as planned, and additional outputs were achieved using the remaining funds. Package 3 (actual amount: 35,077 thousand yen) and Package 4,[17] "Installation of IT seismic intensity meter and guidance on operation and maintenance" (actual amount: 59,985 thousand yen), are additional outputs using the remaining funds. The former is an additional procurement of equipment for BMKG and does not include installation. The latter is the installation of 198 IT seismic intensity meters[18] procured under Package 2, selecting appropriate sites, installing the equipment as well as providing guidance on installation, operation, and maintenance (no procurement). Initially, the equipment provision included only procurement, but as it was expected that it would take time to install the IT seismic intensity meter due to the delay in securing the budget for BMKG, it was proposed that the Japanese side install the IT seismic intensity meter in light of the importance and urgency of expanding the observation network.

[16] The procurement for this project was done through a procurement agent. Therefore, the planned amount is the amount indicated in the Detailed Design Survey.
[17] The formal name is "IT seismic intensity meter installation and guidance for operation and maintenance." However, to avoid confusion, "Package 4" denotes the above component in this report.
[18] Two sets of the 200 sets in total were excluded as they were installed at BMKG headquarters.

Table 2: Planned and Actual Civil Works and Equipment Procurement

Package	Name	Name of the Organization	Equipment	Plan	Actual	Changes from D/D
1	Real-time earthquake observation system	LIPI	Strong-motion seismograph	10 sets	10 sets	None
			PS logging equipment	1 set	1 set	
			Array microtremor measurement equipment	4 sets	4 sets	
2	Real-time earthquake observation system	BMKG	Broadband seismograph	20	20	Change of 13 sites (due to change of use policy by land owners and leaseholders) and the additional survey of the consultant (for survey of 23 sites outside BMKG's hands, where the land owners and leaseholders could not be contacted)
			Broadband strong-motion seismograph	20	20	
			Strong-motion seismograph	93	93	
			Equipment for BMKG headquarters	1	1	
			Civil works for constructing new stations	73	73	
			Solar power generation facilities	9	9	
			Satellite communication system	93	93	
			IT seismic intensity meter	200	200	
3	Real-time earthquake observation system	BMKG	Multichannel elastic wave exploration equipment	—	1 set	All of them are the changes from O/D or D/D because they were added with the use of the balance.
			Array microtremor measurement equipment	—		
			A. Array microtremor measurement equipment	—	8 sets	
			B. Wireless LAN unit	—	2 sets	
			C. Data analysis software	—	2 sets	
4	Installation of IT seismic intensity meter as well as guidance for operation and maintenance	BMKG	IT seismic intensity meter	—	198 sets	All of them are the changes from O/D or D/D because they were added with the use of the balance.
			Uninterruptible power-supply system	—	198 sets	

Source: Documents provided by JICA

Strong-motion seismograph
Source: Material from JICA

Broadband seismometer
Source: Material from JICA

Broadband strong-motion seismograph
Source: Material from JICA

2) Consulting services / software components

Table 3 shows the planned and actual consulting services. All were implemented as planned. The capacity building program (soft component) was not included in this project.

Table 3: Consulting Services

Plan	Actual
Preparation of bidding documents	same as on the left
Bidding and contract assistance	same as on the left
Supervision of equipment installation	same as on the left

Source: Documents provided by JICA

(B) Items borne by the Indonesian Side

The planned and actual results of the counterparts' contribution were as follows. It was implemented as planned except for the installation of eight strong-motion seismographs of the equipment provided to LIPI.

Table 4 Items Borne by the Indonesian Side

Plan	Actual
1. Conclusion of electricity contract for operation of the equipment (for BMKG package)	Implemented as planned.
2. Budgetary allocation for data communication (for BMKG package)	- ditto -
3. Establishment of operation and maintenance system of earthquake observation systems (for BMKG package)	- ditto -
4. Establishment of operation and maintenance system of earthquake observation systems (for LIPI package)	Two of the ten strong-motion seismographs were installed at BRIN, and the remaining eight and other equipment are stored at BRIN's warehouse. These eight sets were supposed to be installed in universities (Padang State University in West Sumatra Province, Syiah Kuala University in Aceh Province, etc.), but this did not happen because the budget for installation could not be secured in 2019 and the government budget for 2020-2022 was restructured due to the COVID-19 pandemic.[19] At the time of ex-post evaluation, the maintenance and management system at BRIN was in place, but the future will be described in the Sustainability section.
5. Proper operation and maintenance after handing over (for both BMKG and LIPI packages)	Regarding BRIN, it has been partially unimplemented with the same reasons mentioned in 4 above. Regarding BMKG, it was implemented as planned.

Source: Preparatory Survey Report p3-2, BMKG Questionnaire

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 1,500 million yen for the Japanese side and within the plan as the planned cost was 1,500 million.[20] As aforementioned, the residual funds were also used. The total cost of equipment procurement and of Package 4,[21] which was included in the actual input, was 1,224 million yen, broken down by package as follows. Whereas the equipment provided to BMKG under Package 2 accounted for 88% of the total equipment, the equipment provided for LIPI accounted for only 4%, a small proportion. The cost of consulting services, including Package 4, totaled 239 million yen.[22]

[19] Questionnaire for and interview with BRIN

[20] The procurement for this project was done through a procurement agent. Therefore, the planned amount is the amount mentioned in the E/N, and the actual amount is the contract amount.

[21] As aforementioned, Package 4 did not include equipment procurement but only equipment installation and guidance for operation and maintenance. Although Table 5 includes Package 4 for the purpose of comparing the cost of the packages, the cost of Package 4 is part of the consulting services cost in terms of financial management.

[22] The amount includes the cost of Package 4, i.e., 56 million yen, as Table 5 shows.

Table 5: Actual Cost of Each Package for Equipment

Package	Organization	Actual Amount (million yen)	Ratio (%)
1	LIPI	55	4
2	BMKG	1,084	88
3	BMKG	29	2
4	BMKG	56	4
Total		1,224	98

Source: Documents provided by JICA
Note 1: Percentages do not add up to 100% due to rounding to the nearest million yen, but the actual figure is 100%.
Note 2: From the financial aspect, Package 4 is part of the consulting service fee.

This project had residual funds of approximately 270 million yen from the beginning. The major reasons are as follows: 1) This project was an emergency comprehensive grant aid project using the third supplementary budget after the Great East Japan Earthquake, and the contents and structure of the main equipment and the grant amount had already been decided at the time of basic design. 2) The cost estimate of installation work based on JICA standards may not have been appropriate for the actual situation (lower than the actual). (The cost of managing 100 construction sites over 5,000 km from east to west (personnel costs for managers, airfare, accommodation, etc.) should have been added to the actual construction cost per site, but JICA's cost estimation rules do not allow for such an increase). 3) At the bidding stage, the successful bidder won the contract at 86% of the consultant's cost estimate due to corporate efforts.[23]

3.2.2.2 Project Period

The project duration in the original plan was 24 months.[24] During the implementation stage, the project was extended twice. Of these extensions, the one for the implementation of Package 4 using the residual funds (5 months, from February 2019 to mid-July 2019) is considered an addition to the scope because it was beyond the original plan's scope and agreed on through an appropriate process. Therefore, with the addition of the above extension period, the planned period is 29 months.

The actual project period lasted from November 2013 to July 2019 (69 months).[25] Table 6 shows the breakdown.

[23] Information collected through email from the consultant
[24] Because of the procurement agency method, the count is taken from the month the GA is signed. In addition, completion is defined as completion of construction.
[25] Because this project is a procurement agency method and materials and equipment are added in Package 3, it is a "case that the planned quantity (output) is being modified." For this reason, the period of project implementation with the residual funds is included in the actual results.

Table 6: Planned and Actual Project Period

	Plan (2012)	Actual (2023)
Conclusion of Grant Agreement (G/A)	November 2013	November 2013
Detailed Design	No description on the Ex-ante Evaluation Sheet or implementing schedule	August 2015 – March 2016 (8 months)
Bidding	August 2015 – July 2016 (12 months)	September 2016 – December 2016 (4 months)
Equipment Procurement and Civil Works	August 2016 – July 2017 (12 months)	May 2017 – July 2019 (27 months)
Extension for Package 4	Mid-November 2018 – Mid-April 2019 (5 months)	Mid-February 2019 – Late July (5 months)
Completion	July 2017	July 2019
Total	29 months	69 months

Source: Document provided by JICA for the planned bidding period, equipment procurement, and construction period at the time of the ex-ante evaluation. The number of months at the time of planning is based on the Ex-ante Project Evaluation Sheet and the actual results at the time of ex-post evaluation on documents provided by JICA.

The project period was 237% of the plan and therefore significantly exceeded the plan. “The real-time earthquake observation system equipment (Package 3)” was provided, and “installation of IT Seismic intensity meter and guidance of operation and maintenance” were conducted additionally using the residual funds (both completed in July 2019). Delays in concluding G/A and Banking Arrangement due to procedural delays on the Indonesian side, contract negotiations with the procurer of Package 2, additional software, and extension of the procurement and installation period due to changes in satellite communication companies, etc., led to project delays.[26]

As aforementioned, the project outputs were mostly achieved as planned, and additional components were implemented with the residual funds. The items to be borne by the Indonesian side were implemented as planned, with the exception of the non-installation of some of the equipment provided to LIPI. On the other hand, the project cost was 100% of the plan, but the project period was 237% of the plan. Therefore, efficiency of the project is moderately low.

3.3 Effectiveness and Impacts[27] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 7 shows the actual values of the operation and effect indicators for quantitative effects

[26] Questionnaire for the consultant
[27] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

set at the time of planning.

Table 7: Operation and Effect Indicators

	Basic value (2014)	Target value (2022) 3 years after completion	Actual value		
			2020	2021	2022
1. Time required to determine the earthquake source of large-scale earthquakes (minutes)	5	3	2	2	2
2. Time required to announce tsunami warning publicly (minutes)	5	3	4.1	4.7	3.8
3. Time required to prepare seismic intensity maps (minutes)	7	5	4.1	4.7	3.8
4. Time required to announce isoseismal map publicly (modified to ShakeMap) (minutes)	60	30	30	30	30
5. Collection rate of observed seismic data (%)	70	90	**90.2**	**88.5**	**90.5**
IT seismic intensity meter			99.5	96.5	100
Strong-motion seismograph			73.2	83.9	88.2
Broadband seismometer			93.8	87.2	87.9
Broadband strong-motion seismograph			94.5	86.7	85.9

Source: Ex-ante Evaluation Sheet P4, questionnaire for and interview with BMKG

Note 1: At the time of planning, Indicator 3 was described as "to be announced through BNPB," but at the time of ex-post evaluation, BMKG uploaded to its website.

Note 2: Indicator 4 is uploaded to BMKG's website.

Note 3: According to an interview with BMKG, Indicator 4 has been changed to ShakeMap because it is now technically possible to create a ShakeMap.

Among the five indicators, the time required to determine the source of a large-scale earthquake (indicator 1), and to prepare for seismic intensity maps (indicator 3) were achieved, exceeding the target value. And the time to announce isoseismic intensity maps publicly (indicator 4) (as it became technically possible to create ShakeMaps, these were changed to ShakeMaps) were achieved. The collection rate of seismic observation data (Indicator 5) was also mostly achieved. However, the broadband strong-motion seismographs[28] were not utilized for the analysis of seismic observations although the observation data were received. Although the broadband strong-motion seismographs[29] were located at the same stations as the broadband

[28] The broadband strong-motion seismograph is a seismometer that has strong-motion and broadband strong-motion seismometer functions and is a technology unique to Japan (interview with expert from Indonesia (TC project), "Project to Improve Earthquake and Tsunami Observation and Information Dissemination Capacity"). A strong-motion seismograph is a seismometer that can record strong tremors caused by earthquakes of large magnitude without shaking.
URL: https://www.jishin.go.jp/main/pamphlet/wakaru_shiryo2/wakaru_shiryo2_5.pdf (accessed July 28, 2023).
[29] Broadband seismometers can record ground shaking over a wide range of frequencies, from very slow to fast vibrations. The observation network of broadband seismometers can help comprehend the mechanism of fault

seismographs, only one of them could be recognized at a time due to software limitations, and the broadband seismographs were given priority.[30]

On the other hand, the time to issue a tsunami warning (Indicator 2) was not achieved. It is necessary to collect more necessary data and carefully analyze them for issuing accurate warnings because tsunami analysis requires more data and modeling than that of earthquakes, and Indonesia does not have seismic observation equipment installed in the ocean, unlike Japan. This is also recognized as one of the reasons for the failure.[31] At the time of ex-post evaluation, BMKG's standard operating procedures (SOPs) stipulate a tsunami warning should be issued within 4 minutes, so BMKG's internal standard had been achieved by 2022.

Based on the above, it is believed that the operational and effectiveness indicators for quantitative effects have been mostly achieved. However, it is an issue that the data from the broadband seismograph was not actually utilized.

3.3.1.2 Qualitative Effects (Other Effects)

Table 8 shows the actual status[32] of the qualitative effects at the time of ex-post evaluation, which were assumed at the time of planning.[33] The improvement of the capacities for disaster initial and emergency responses and restoration is analyzed in the Impact section

Of the five indicators, earthquake observation accuracy (Indicator 1) and early damage estimation (Indicator 2) are believed to have been achieved. Calculation accuracy of magnitude estimation (indicator 3) and data accumulation and research (indicator 4) has been high since the time of planning to the time of ex-post evaluation, and no significant changes were observed. On the other hand, although some contributions to BRIN's research on ground characteristics (Indicator 5) were observed, the level of contribution has not reached the expected level because some of the equipment has not been utilized. However, when we look at the breakdown of equipment cost, the equipment provided to BRIN accounts for only about 4% of the total equipment cost.

movement for earthquakes of magnitude 3 or greater and the progress of fault rupture in the epicenter region. URL: https://www.jishin.go.jp/main/pamphlet/wakaru_shiryo2/wakaru_shiryo2_5.pdf (accessed on July 28, 2023).

[30] Interview with BMKG

[31] Interview with and information through email from BMKG

[32] It was explained that these effects did not occur due to the project alone but also due to the BMKG's budgetary measures and capacity (questionnaire for and interview with BMKG).

[33] The Ex-ante Project Evaluation Paper p.4

Table 8: Qualitative Effects

No.	Qualitative Effect	Actual status
1	The accuracy of the analysis of earthquakes and observations is improved.	The accuracy of seismic observation has improved (on a 5-point scale, the accuracy was 4 at the time of project completion and ex-post evaluation and 3 at the time of planning, showing an improvement). The high accuracy of the provided equipment, such as seismic intensity meters and strong-motion seismographs, contributed to this improvement.
2	Rough damage estimations are possible at an early stage.	Rough damage estimations have improved; on a 5-point scale, they were rated a 2 at the time of planning, 3 at project completion, and 4 at ex-post evaluation. At the time of planning, it was done manually, but since being automated in 2017, it has gradually improved.
3	The accuracy of the earthquake source and magnitude calculation is enhanced.	No significant change has arisen in the accuracy of the calculation of the epicenter and magnitude estimates, which BMKG rates a 4 on a 5-point scale for planning, completion, and post-evaluation.
4	The data is collected and accumulated for review and analysis for introducing the early warning system in the future.	BMKG recognizes that no major changes or problems have arisen in data accumulation and research since the time of planning and that it was rated a 4 on a 5-point scale at the time of the planning and at the time of the ex-post evaluation.
5	The project contributes to estimation of ground strength, understanding of ground characterization, acquisition of seismic waves and seismic waveforms, and comprehension of seismic characterization in the research conducted by LIPI.	Regarding the equipment provided to BRIN, as mentioned regarding the efficiency of the items to be borne by the Indonesian side, 8 of the 10 strong-motion seismographs have not been installed. Therefore, the effect of acquiring seismic waves and seismic waveforms and understanding seismic characteristics has not emerged. On the other hand, PS loggers and microtremor array probes began to be utilized in 2019 in a study on liquefaction in Central Sulawesi (Palu and Sigi) and has been utilized in 2023. Because the study is intended to comprehend geotechnical characteristics, they have contributed to the estimation of ground strength and the understanding of geotechnical properties.

Sources: The ex-ante Evaluation Sheet, BMKG questionnaire and interview, BRIN questionnaire and interview

Based on the above, the expected qualitative effects have emerged.

3.3.2 Impacts

3.3.2.1 Intended Impacts

At the time of planning, there was no intended impact assumed by the project. However, the "improvement of capacities for disaster initial and emergency responses, and restoration through the sharing of more accurate earthquake information with BNPB and other disaster management agencies" that was assumed as one of the qualitative effects of effectiveness is analyzed as an assumed impact because it is expected to be realized as a result of improved earthquake and tsunami analysis capacities.

The seismic information from BMKG is shared with BNPB and other government agencies related to disaster management through the Indonesia Tsunami Early Warning System (Ina-TEWS) software. However, the expected impact has not been achieved because the linkage between the improved accuracy of BMKG earthquake information and the improved capacities of government agencies related to disaster management for disaster initial and emergency responses and restoration has not been confirmed. Actual warnings for residents are issued by the provincial, district, and regency levels of Regional Disaster Management Agency (BPBD) based on earthquake information the BMKG provides, but there are large differences in capacity among municipalities, and there is no data showing nationwide trends.[34] In addition to the BPBD, other government bodies, such as the military and police, that are involved in evacuation, etc., also play an important role in initial and emergency responses. Therefore, it is logically difficult to expect to improve capacities for initial and emergency responses and restoration after earthquakes and tsunamis only by improving the accuracy of seismic information. This may be attributed to the fact that external conditions beyond the implementing agencies' control were too large and the level of impact set at the time of planning was too high.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Environment

No negative environmental impacts were found. Because the construction zone of the seismic station building was very small, no environmental assessment was required in this regard.[35]

2) Resettlement and Land Acquisition

No land acquisition or resettlement occurred during the implementation of this project.[36]

3) Gender Equality

4) Marginalized People

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

No positive or negative impact was observed as to 3) to 5).[37]

6) Unintended Positive / Negative Impacts

The improvement of the accuracy of Ina-TEWS observation data through the equipment provided by this project directly affected the improvement of the accuracy of data from the UNESCO-led IOTWS, which utilizes Ina-TEWS data.[38] In addition, some of the equipment provided to BRIN was used for undergraduate thesis guidance.[39] No negative impact was observed. Therefore, a positive impact was observed as the other impact.

The operation and effect indicators of quantitative effects as well as indicators of qualitative

[34] Interview with BNPB
[35] Questionnaire for and interview with BMKG
[36] Questionnaire for BMKG
[37] Questionnaire for BMKG
[38] Questionnaire for BMKG
[39] Interview with BRIN

effects for effectiveness were mostly achieved. The project's expected impact cannot be said to have been achieved because no linkage was confirmed between the improved accuracy of BMKG's earthquake information and the status of improved capacities of the government agencies related to disaster management for disaster initial and emergency responses and restoration. On the other hand, no negative impact was observed, and some positive impacts, such as improvement of IOTWS data accuracy, were observed. Therefore, the impact is mostly achieved.

In conclusion, this project has mostly achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

The project has been highly consistent with Indonesian policies since the time of planning to the time of ex-post evaluation, as stated in the Relevance section. In particular, at the time of the ex-post evaluation, *the National Disaster Management Plan 2020-2024* calls for further strengthening of earthquake information systems and tsunami early warning, and *the RPJMN 2020-2024* calls for "strengthening the environment and improving resilience against natural disaster and climate change." In Indonesia, where large-scale earthquakes occur frequently, the importance of earthquake and tsunami observation in policy is unlikely to change in the future, considering the policy direction regarding the strengthening of disaster prevention up to the time of ex-post evaluation.

3.4.2 Institutional/Organizational Aspect

The functions and positioning of BMKG have not changed since the time of planning. The number of staff in the two departments related to this project at BMKG; Earthquake and Tsunami Department (PGT) and Seismology, Potential Geophysics and Time Signal Department (PSGT) increased from 95 in 2014 to 147 in 2022. As for the maintenance and management system at BMKG, seismic intensity meters are maintained by BMKG staff and strong-motion seismograph are maintained by an external contractor. The number of maintenance and management personnel was sufficient from 2019 to 2021, with five PSGT staff and a local contractor, but more technical staff is expected to be needed in the future. Therefore, BMKG plans to increase the number of staff and aims for digitalization and automated monitoring.[40]

Meanwhile, LIPI was merged into BRIN due to governmental restructuring. The Research Center for Geological Disaster of BRIN in Bandung has operated and maintained the equipment provided to LIPI since its merger. There was one maintenance personnel from 2019 to 2021 and two in 2022. However, in January 2023, the Directorate General of Infrastructure, Research, and

[40] Questionnaire for BMKG

Innovation, which is responsible for the operation and maintenance of all BRIN equipment, indicated that the equipment in Bandung, including the equipment provided under this project, may be centrally managed at BRIN's facility in Serpong, Banten Province. If this policy is implemented, researchers will need to apply for the use of the equipment each time they want to use it, and they will need to cover their transportation expenses. In addition, at the time of the ex-post evaluation, the responsible department at Serpong had no personnel familiar with the operation and maintenance of the equipment in question.[41] Therefore, concerns arose about the future operation and maintenance of the equipment. As a result of internal discussions in BRIN in February 2023, it was decided that BRIN in Bandung would manage the equipment provided under the project for the time being.[42] According to the BRIN in Serpong, the handling of the equipment is still under discussion.[43] As background for this issue, BRIN, which was formed through the merger of a number of government research institutes, had many overlapping research equipment and facilities, so it has been reorganizing its research facilities and equipment to ensure efficient operation and maintenance of the facilities and equipment as well as equal access to the facilities and equipment for all researchers. By consolidating research facilities and equipment into multiple locations based on similarities and hiring new undergraduate graduates to maintain and operate them, BRIN aims to create a system in which researchers can concentrate on their research. However, for special equipment that requires advanced handling, the operation, maintenance, and management of the equipment will be assigned to researchers in specialized fields. At the time of the ex-post evaluation, it has not been determined into which category the procured equipment will be classified.[44]

Therefore, there is no problem with BMKG, which is this project's main target. Regarding BRIN, there is no problem at the time of ex-post evaluation, but it is necessary to monitor the transition of the maintenance management system in the future.

3.4.3 Technical Aspect

Regarding the operation and necessary maintenance skills for the procured equipment, there is no problem for BMKG.[45] BRIN has no problem at the time of ex-post evaluation, but if the equipment is transferred to Serpong as per the abovementioned policy of centralized management of all equipment and if the equipment is not recognized as special equipment that requires advanced handling, concerns will arise about the maintenance and management technology. The assignment of personnel with sufficient skills is necessary to ensure sustainability.

The unification of communication methods for BMKG that was envisioned at the time of

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[41] Interview with Research Center for Geological Disaster, BRIN
[42] Reply by email from BRIN (Bandung) in April 2023
[43] Interview with BRIN (Serpong)
[44] Interview with BRIN (Serpong)
[45] Questionnaire for BMKG

planning did not take place as envisioned; problems occurred with VSAT[46] satellites, and after considering its cost performance and other considerations, the switch to GSM[47] began in 2021 (23 sites in 2021, 18 sites in 2022 were already switched. 31 sites will be switched in 2023). VSAT is more stable and powerful than GSM, but GSM is superior in terms of budget, and BMKG expects the quality of GSM to improve in the future.[48]

3.4.4 Financial Aspect

Table 9 shows the actual expenditures for the BMKG. Comparison of actual expenditures in 2013, the year of commencement, and the year of completion (2019) reveals a significant increase in the year of completion. Although fluctuations occurred in expenditures after the project was completed, the level of expenditures has remained almost the same as in the year of completion, with the exception of 2020, and no problems have been observed.

Table 9: Budget Status of BMKG

(Unit: Million Indonesian Rupiah)

	2013 (Commencement year)	2019 (Completion year)	2020	2021	2022
Expenditure	1,434,225	2,408,284	2,076,802	2,462,938	2,398,121

Source: BMKG

Tables 10 and 11 show the budget status of the responsible departments in LIPI and BRIN.

Table 10: Budget Status of LIPI (Before the Start of the Project)

(Unit: Million Indonesian Rupiah)

	2010	2011	2012
Total Budget of LIPI	512,629	771,005	769,276
(of which) Research Center for Geotechnology	17,390	18,535	24,672

Source: Preparatory Survey Report p2-10

[46] VSAT stands for “very small aperture terminal,” a nano-satellite communications Earth station with a 2-meter-class antenna or smaller, generally used for corporate communications and anti-disaster applications because VSAT is always operated under the control and monitoring of an Earth station, It can be easily deployed without the need for radio personnel (Source: https://www.soumu.go.jp/main_sosiki/joho_tsusin/policyreports/joho_tsusin/idou_eisei/pdf/081226_1_si1-3-1.pdf) (accessed on July 28, 2023).
[47] GSM stands for Global System for Mobile communications and is a type of digital communication system used in cell phones. It is used in Europe, North America, Asia, Africa, and other regions (source: https://kotobank.jp/word/GSM-3865 accessed on July 28, 2023).
[48] Interview with BMKG

Table 11: Budget Status of BRIN (After Project Completion)

(Unit: Million Indonesian Rupiah)

	2020	2021	2022
Research Center for Geological Disaster	N/A	N/A	5,000

Source: Research Center for Geological Disaster, BRIN

The budget of the Research Center for Geotechnology, LIPI, before the project implementation was on the rise. Comparing this budget with that of the Research Center for Geological Disaster, BRIN at the time of the ex-post evaluation, the budget at the time of ex-post evaluation has decreased significantly because the assumption that the research and maintenance budgets are annually allocated is no longer valid due to a change in government policy, and if research expenses including equipment maintenance cost requested in the proposal are obtained on a competitive basis internally and externally by, the maintenance budget can be secured during the implementation of the relevant research. Although data on the budget for the Research Center for Geological Disaster for 2020 and 2021 were not available, BRIN's internal research budget of Rp. 5,000 million was obtained on a competitive basis in FY2022.[49] Although it cannot be necessarily said that there is a serious budgetary problem at the time of ex-post evaluation, it is necessary to monitor future trends in the maintenance budget and research expenditures. However, as aforementioned, equipment for BRIN accounts for only about 4% of the total equipment cost, which is a small percentage of the total equipment provided.

3.4.5 Environmental and Social Aspect

As stated in the Impact section, the project is considered to have minimal undesirable impact on the environment and was judged as Category C in *the JICA Guidelines for Environmental and Social Considerations (2010)*. Because the project involves the provision of seismic-observation equipment, no negative impact on the natural environment was observed during the project implementation or at the time of ex-post evaluation,[50] and such an impact is unlikely to occur in the future.

3.4.6 Preventative Measures to Risks

As mentioned in the Relevance section, based on the lessons learned from similar projects in the past, it was intended to mitigate the risk of reduced project effects due to lack of operation and maintenance by implementing a TC project ("Project to Improve Earthquake and Tsunami Observation and Information Transmission Capability") to maintain the equipment provided and strengthen the Ina-TEWS.[51] However, as mentioned in the Coherence section, it is expected to

[49] Interview with BRIN
[50] Interview with BMKG and BRIN
[51] The Ex-ante Project Evaluation Paper p.3

take more time to realize the project's benefits fully because the start of the TC project was delayed due to BMKG's response to the Palu earthquake and the COVID-19 disaster.[52]

3.4.7 Status of Operation and Maintenance

At the time of ex-post evaluation, most of the equipment provided to BMKG was being maintained and managed extremely well. However, the software provided to the BMKG headquarters was not user friendly due to its complexity and inability to improve the system (it was not an open system), but this problem was solved by integrating it into the national system.[53] As for the satellite communication system, there was a problem with VSAT in the past, but the system has been gradually shifted to GSM, and it has been improved. The observation stations are expected to be maintained according to Indonesian standards in the future from a budgetary perspective.[54] As mentioned in the Effectiveness section, although the broadband strong-motion seismograph data was received, it was not utilized in the analysis of seismic observations at the time of the post-evaluation. On the other hand, in the activities of the ongoing "Project to Improve Earthquake/Tsunami Observation and Information Dissemination Capability" (the TC project), there is a discussion that "the strong-motion seismic data should be more utilized to improve the accuracy of magnitude calculation," and the use of strong-motion seismometers and broadband strong-motion seismometers[55] has been reviewed. Therefore, they may be used for analysis in the future; thus, the operation and maintenance status of BMKG at the time of ex-post evaluation is generally good.

As for the operation and maintenance of equipment by BRIN, two of ten strong-motion seismographs have been installed and are in operation, but the remaining eight are not being utilized at the time of ex-post evaluation. The expected installation at distant universities and local governments was abandoned due to budget problems. The installation is scheduled to take place in 2023 (two sets in August and six sets in December) in the vicinity of Bandung and other locations, while the budget is already secured. The installation will be done using telemetry equipment with the secured budget, so it will be unnecessary to pay for transportation to use the strong-motion seismographs installed in remote locations. All equipment other than the strong-motion seismograph is portable and brought to the survey site, so it is usually stored in BRIN's storage facility and used as needed.[56] However, as aforementioned, the equipment still may be moved to BRIN in Serpong, and it is necessary to monitor the situation in the future.

Based on the above, slight issues have been observed in the institutional/organizational,

[52] Interview with Expert of the TC project mentioned above
[53] Interview with BMKG
[54] Interview with BMKG
[55] Interview with Expert of the aforementioned TC project
[56] Questionnaire for and interview with BRIN

technical, and financial aspects. However, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.


Installed IT seismic intensity meter
(Source: photo taken by the evaluator)


PS logging equipment
(Source: photo taken by the evaluator)

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to enhance the capacity for earthquake and tsunami analysis and to improve the accuracy of seismic source and seismic intensity analysis by providing seismic observation equipment to the BMKG and LIPI (which was merged into the BRIN of Indonesia), which are the Indonesian seismic observation agency and research institution, respectively, thereby contributing to the enhancement of the country's disaster prevention capacity. This project, which is intended to strengthen the capacity for earthquake and tsunami analysis, is highly consistent with Indonesia's policy and development needs and aligned with Japan's ODA policy at the time of planning. Although the project and a TC project were intended to be linked at the time of planning, the commencement of the TC project was delayed until after the completion of this project due to the Palu earthquake and the COVID-19 pandemic. Therefore, there was no linkage between the two projects. Although there was no planned and coordinated linkage with the projects supported by other aid agencies, the project is consistent with the direction of the Sendai Framework for Disaster Reduction 2015-2030. Therefore, the project's relevance and coherence are high. The project outputs were mostly achieved as planned, and additional components were implemented with the residual funds. Although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, the project's efficiency is moderately low. The quantitative and qualitative effects of the project objective, i.e., the enhancement of capacity for earthquake and tsunami analysis, were mostly achieved. Although the project did not achieve the expected impact of improving the capacities of government agencies related to disaster prevention for initial and emergency responses and restoration, some positive impacts emerged, such as enhancement of the accuracy of the UNESCO-led IOTWS, and utilization of some of the equipment provided to BRIN for undergraduate students' thesis guidance. Therefore, effectiveness and impacts of the project are high. Slight issues have been observed in the institutional/organizational, technical, financial aspects. 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

Due to the restructuring and the COVID-19 pandemic, eight strong-motion seismographs out of the equipment provided to LIPI under the project have not been installed at the time of the ex-post evaluation. It is recommended that BRIN, which merged LIPI, install the above eight strong-motion seismographs by the end of 2023, properly operate and maintain the equipment under appropriate personnel, and properly operate and maintain other equipment provided under this project.

4.2.2 Recommendations to JICA

(1) The JICA Indonesia Office and JICA Global Environment Department are hoped to monitor the progress of the "Project for Capacity Enhancement of Earthquake and Tsunami Observation and Information Dissemination," taking also into account the point of view to enhance this project's sustainability and to provide support as necessary.
(2) The JICA Indonesia Office should monitor the installation of the remaining equipment by BRIN and the maintenance of the equipment by BRIN and BMKG and provide advice as necessary.

4.3 Lessons Learned

Setting Impact and Authority of Implementing Agencies for Equipment Provision Projects

This project is a grant aid project to provide earthquake observation equipment. The expected impact of this project was to contribute to the improvement of the partner country's disaster management capacity, specifically to "improve the capacities for initial and emergency responses and restoration" by sharing more accurate earthquake information with disaster management-related organizations. On the other hand, the counterpart implementing agency is an agency that collects, analyzes, and shares earthquake observation data with related agencies (BMKG) and conducts research (LIPI). Although many government agencies, including BNBP and other ministries, local governments, police, and the military, play an important role in the disaster initial and emergency responses and restoration, they are not included in the mandate of the implementing agency for this project. The implementing agencies have no room to influence how disaster management-related agencies will respond after receiving the analysis and dissemination of earthquake information. In other words, the expected impact of the provision of equipment is largely dependent on factors over which the project and implementing agencies have no control because the level of the overall goal set at the time of planning was too high. Furthermore, no information was available to determine nationwide trends in the disaster initial and emergency responses of local governments, which are responsible for notifying residents of disasters, making it difficult to verify the improvement of these capacities.

When setting the level of impact for equipment provision projects, it is important to consider the roles of the implementing agency, other government agencies, and local governments as well as the degree of influence of social factors other than equipment provision before setting the appropriate level. In addition, it is important to set it after confirming verifiability of achievement level.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

BMKG and LIPI received the right support from the consultant and the JICA Indonesia office.[57]

5.2 Additionality

None.

(End)

[57] Questionnaires for BMKG and BRIN