Federative Republic of Brazil

FY2020 Ex-Post Evaluation of Technical Cooperation Project

"Project for Strengthening National Strategy of Integrated Natural Disaster Risk Management"

External Evaluator: Mitsue Mishima, OPMAC Corporation

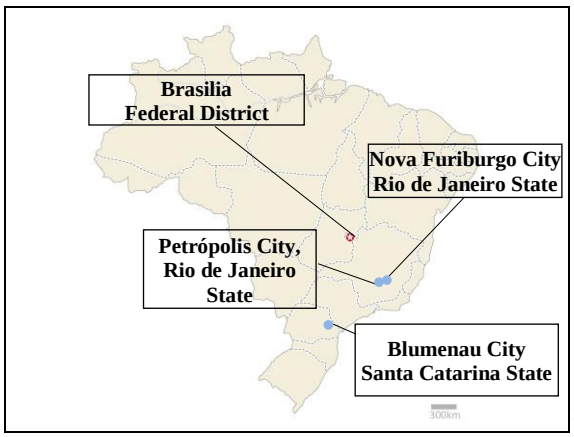
0. Summary

This project supports capacity building for the risk assessment on sediment disasters, formulating and implementing, based on such risk assessment, urban expansion plans and disaster prevention/rehabilitation/reconstruction plans, issuance of early warning and dissemination of risk information, and research and development on disaster monitoring as well as forecast and early warnings. Through these capacity building activities, the project aims to improve Brazil's preparedness for disaster response and thereby contributes to strengthening its integrated national strategy for natural disaster risk management. This project is consistent with the needs of Brazil's development plans and policies as well as the efforts made by the governments on federal, state, and municipal levels to prevent disasters. The project is aligned with the Japanese government's development aid policies of that time as well. Japan's advanced sediment disaster technologies also contributed to the project. In light of the above, the relevance of the project is high. The project delivered outputs related to capacity strengthening of pertinent organizations and agencies in four areas: risk assessment on sediment disasters; formulation and implementation of urban expansion plans as well as disaster prevention, rehabilitation, and reconstruction plans; protocol of early warning; and system of monitoring and prediction. The federal government officially approved manuals and other products of this project for these areas as the national guidelines to be referred in Brazil, and therefore, the effectiveness of the project is high. One of the verifiable indicators for the Overall Goal, i.e., project outputs will be reflected on the disaster risk management program in the multi-year federal government plan (*Plano Plurianual*, hereinafter referred to as "*PPA*") (2020-2023) at the time of the ex-post evaluation, was partial. However, project outputs were incorporated in policies and training plans of federal government organizations and disaster risk reduction management plans of local governments. In addition, the project had many other positive impacts, including: raised awareness among federal and local authorities about the importance of coordination and cooperation for mainstreaming disaster reduction management; enabled the government to apply risk evaluation and hazard mapping to other locations; contributed to the research on sediment disaster risk in Brazil; led to the formation of JICA's new Collaboration Programs with the Private Sector; and had positive spill-over effects on other donor agencies. Therefore, the impact of this project is considered high. With regard to the efficiency, the delay in project implementation was managed within a minimal level, but the project has experienced some cost overrun and extension of the cooperation period. Therefore, the efficiency of the project is fair. Concerning the policy and political aspects of sustainability of project effects, the context as the federal government program has waned due to political

influence and other factors; however, project outputs are partially incorporated in the activities of each federal government organization and the operations of local governmentss. As for institutional and organizational aspects, all project's products were enacted by federal and local authorities, but the collaborative institutional arrangement between federal and local governments, established under this project, is no longer functioning. The sustainability of technical aspects is high, as seen in the case of technologies mastered by participating organizations and agencies under the project. Concerning financial aspects, a certain level of the budget has been allocated by the federal government for training programs to disseminate project outputs and by municipal governments for disaster reduction activities. Considering the mixed results across aspects and organizations, the overall sustainability of this project is fair.

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

1. Project Description



Project Site

Source：JICA

Meeting at a Federal Government Organization during project implementation

1.1 Background

The Federative Republic of Brazil (hereinafter referred to as Brazil) has experienced a sudden acceleration in urbanization since the 1950s. Along with rapid development, the population living in the disaster risk areas increased through illegal land uses. Urban areas have been expanding to the risk-prone parts in recent years, causing damages from natural disasters to be more significant. In January 2011, heavy rains in Rio de Janeiro State caused a sediment disaster and flash floods, resulting in the country's most devastating disaster damage induced by rainfall, with approximately 400 missing people, more than 800 lost lives, and about 20,000 people without a home.

Reacting to the sediment disaster in Rio de Janeiro State, the federal government formulated the *Disaster Risk Management and Response Program* that incorporated the disaster risk management concept for the first time and included this program in the *PPA* (2012-15), which is

equivalent to a national development plan in Brazil. To strengthen the disaster risk management system based on the *Disaster Risk Management and Response Program*, the federal government established two centers. The National Center for Monitoring and Warnings of Natural Disasters (Centro Nacional de Monitoramento e Alertas de Desastres Naturais, hereinafter referred to as "CEMADEN") was set up within the Ministry of Science, Technology and Innovation (Ministério da Ciência, Tecnologia, e Inovaçõe e Communicacão, hereinafter referred to as "MCTIC") in December 2011, with an aim to strengthen capacity for precipitation prediction and monitoring. In August 2012, the National Center for Risk and Disaster Management (Centro Nacional de Gerenciamento de Riscos e Desastres, hereinafter referred to as "CENAD") was established in the Ministry of National Integration (Ministério da Integração Nacional, hereinafter referred to as "MI") to strengthen disaster risk assessment and response. As a result, the system was set up where CEMADEN issues early warnings to CENAD and CENAD, in turn, disseminates warnings and risk information, including evacuation advisory, to municipalities. Moreover, MI planned to develop disaster risk maps for 286 municipalities by 2013, and 821 municipalities by 2014. Based on disaster risk assessments, the Ministry of Cities (Ministério das Cidades, hereinafter referred to as "Mcidades") was expected to provide municipalities, responsible for urban expansion planning, with land use standards that have incorporated disaster risks.

However, this system had been just established by laws, and the forecasting by CEMADEN lacked sufficient accuracy. There was a need to improve CEMADEN's forecasting capabilities for sediment disasters possibly triggered by rainfalls. In addition, the disaster risk maps to be developed by CENAD did not take such factors as geologic features and soil water index into consideration. The development of accurate disaster risk maps requires evidence-based risk assessments. Furthermore, the land use regulations, which prevent illegal uses of land supervised by MCidades, have not been legislated. Therefore, it was necessary to take a more comprehensive approach that considers each aspect of monitoring, early warning, risk assessment, and urban planning.

Against this background, the Government of Brazil requested technical cooperation from Japan, a country prone to disasters and known for its superior technologies for nonstructural measures, such as risk area assessment on sediment disaster, urban expansion planning, rehabilitation and reconstruction, and early warning system development in the world. Project components mainly relates to these measures and JICA started this technical cooperation project with a planned project period of four years, starting July 2013.

1.2 Project Outline

Overall Goal		Sediment disaster risk is reduced according to non-structural measures based on risk assessment.
Project Purpose		Disaster management cycles, which consist of the urban expansion plan, protocol of early warning and forecast, and system of monitoring and prediction, are established based on risk assessment and risk mapping.
Outputs	Output 1	Strengthen capacity of risk assessment on sediment disaster, including hazard identification, vulnerability analysis, and risk evaluation and mapping.
	Output 2	Strengthen capacity of planning and implementation of risk reduction measures for sediment disaster.
	Output 3	Improve protocol of early warning, risk information dissemination, and methodology of collecting disaster data.
	Output 4	Improve system of monitoring and prediction for sediment disaster mitigation.
Total cost (Japanese Side)		1,100 million yen
Period of Cooperation		July 2013 – November 2017
Target Areas		1) Location of Implementing Agencies Brasília Federal District (Location of MCidades, MI, MCTI, CENAD) São José dos Campos, São Paulo State (Location of CEMADEN) Rio de Janeiro City, Rio de Janeiro State (Location of CPRM) 2）Pilot Project Sites Rio de Janeiro State: Petrópolis City, Nova Furiburgo City Santa Catarina State: Blumenau City
Implementing Agency		Federal government agencies: MCidades*, MI*, CEMADEN, CENAD, MCTIC**, Ministry of Mines and Energy (MME), Geological Survey of Brazil (CPRM)
Other Relevant Agencies / Organizations		State government agencies: Rio de Janeiro State: State Center for Monitoring and Warning of Natural Disasters-RJ(CEMADEN-RJ), Rio de Janeiro Geological Survey (DRM-RJ), Civil Defense School, State of Rio de Janeiro *** （ESDEC） Santa Catarina State: State Secretariat of Civil Defense, State Secretariat of Economic & Social Development Planning Municipal government agencies: Petrópolis City, Nova Furiburgo City, Blumenau City
Supporting Agency/Organizations in Japan		Ministry of Land, Infrastructure, Transport and Tourism of Japan
Related Projects		[JICA Technical Cooperation Project] Capacity Development Project for Structural Measures against Sediment related Disaster for Resilient Cities (5-year project starting 2021. As a follow-up project of this project, the Detailed Planning Survey was conducted in FY2019. The Record of Discussion (R/D) was signed in July 2020.) [JICA Collaboration Programs with the Private Sector to Disseminate Japanese Technology] ・Collaboration Program with the Private Sector for Disseminating Japanese Technology for Steel Slit Dam and Sabo Soil-Cement Gravity Dam (2017-2019)

	・Collaboration Program with the Private Sector for Disseminating Japanese T echnology for Radar Rain Gauge in Paraná State (2017-2019) ・Collaboration Program with the Private Sector for Establishing a Basic Map for Risk Assessment Using Satellite-based Digital Maps (AW3D) (planned for 2019-2021)

* The name used at the time of project implementation. MCidades and MI have since merged to form the Ministry of Regional Development (Ministério de Desenvolvimento Regional ：MDR).

**At the time of project implementation. Currently, Ministry of Science, Technology, and Innovation（Ministério da Ciência, Tecnologia e Inovações: MCTI）

***Civil Defense is a direct translation of the Portuguese word 'Defesa Civil.' In addition to disaster reduction, the word can be used for other emergency efforts, such as those against armed conflicts.

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

It was expected that the project purpose would be achieved by the project termination. It is because project activities related to the approval of manuals and other products, which were included in the indicators for the project purpose, were mostly implemented as scheduled, and the consideration on the formality and procedures for the approval of manuals was underway. During the terminal evaluation, the federal implementing agencies expressed their positive views that all planned activities would be completed in the remaining project period.

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

The terminal evaluation found that the possibility of achieving the overall goal was high. The indicators of the overall goal were: project outputs are reflected in the *PPA*, and the *PPA* is implemented. The *PPA* (2016-2019), published in December 2015, incorporated the *Program 2040 – Disaster Risk Management and Response Program.* The terminal evaluation pointed out that the *Program 2040* highlighted the importance of integrated actions and coordination in disaster risk management, among concerned federal, state, and municipal authorities. According to MCidades, the *Program 2040* directly reflected the discussions held during the project implementation and was developed in coordination and cooperation among four federal implementing agencies and the Ministry of Plan and Budget Management (Ministério do Planejamento, Orçamento e Gestão: MPOG). Similar outcomes were expected for the following *PPA* (2020-2023), and the terminal evaluation survey mentioned that the positive outlook was a reason to assume that the overall goal would be achieved.

1.3.3 Recommendations at the Terminal Evaluation

【Recommendations for Implementing Agencies in Brazil at the Terminal Evaluation】

Recommendation	Situations at the Ex-post Evaluation
Continuation and Expansion of Project Activities Activities (implementation of structural/nonstructural measures against sediment disasters) should be expanded beyond the targeted areas to other areas in the three pilot municipalities. In addition, to accelerate these works in the future, it is advised that each municipality consider utilizing such outside resources as private sectors.	No evidence of municipalities making progress in utilizing external technology resources was confirmed.

2. Outline of the Evaluation Study

2.1 External Evaluator

Mitsue Mishima, OPMAC Corporation

2.2 Duration of the Evaluation Study

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

Duration of the Study: October 2020–December 2021

Duration of the Field Study: No field study was conducted due to the widespread COVID-19 infections in Brazil.

2.3 Constraints during the Evaluation Study

Due to widespread cases of COVID-19 in Brazil, the External Evaluator did not travel to the country. Also, the Local Consultant could not make the planned on-site inspection of pilot project sites due to restrictions imposed on domestic travels. Instead, the External Evaluator and Local Consultant conducted online interviews with officials of implementing agencies and other relevant agencies. This ex-post evaluation was conducted by analyzing the interview findings and information and resources submitted by implementing agencies and other concerned organizations.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Brazil

The project has been consistent with the policies during project implementation since the ex-ante evaluation.

As confirmed during the ex-ante evaluation, the project was in line with the content of the *PPA* (2012-2015) and the *Program 2040 – Disaster Risk Management and Response Program*

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

[2] ③: High, ②: Fair, ①: Low

included in *PPA* (2016-2019). In the *PPA* (2012-2015), the project was aligned with risk evaluation and mapping and monitoring and monitoring in vulnerable area by sediment disaster. In the *PPA* (2016-2019), the federal government promoted and provided state and municipal authorities with financial and other support to take actions towards disaster reduction. The project made direct contribution to the objectives pursued under the *Program 2040* at that time: (1) understanding the natural disaster risks through mapping disaster-prone municipalities; (2) support the reduction in natural disaster risks through structural measures; (3) enhancing capacity to issue early warnings of natural disaster risks through integrated actions among federal, state, and municipal governments; and (4) improving the coordination and management of actions for disaster preparedness, reduction, response and recovery through stronger partnerships between the federal government and foreign agencies. [3]

3.1.2 Consistency with the Development Needs of Brazil

This project has been consistent with the development needs of Brazil during project implementation since the ex-ante evaluation.

Municipal governments are responsible for taking immediate response and emergency actions in times of disaster. Under this project, it became necessary to clarify how the federal government should support municipal governments by setting more concrete guidelines and identifying actions to be taken by federal and local authorities, respectively. The experience of consulting with state and municipal authorities during the pilot projects was significant for the federal government to develop national guidelines suitable for the situations facing local governments. The project's scope includes capacity building of the federal government organizations to conduct risk assessments, predict and monitor rainfalls, and forecast and issue early warnings based on analysis. The project also shared the methodologies and procedures for forecasting and issuing early warnings with relevant parties in pilot municipalities and reflected their feedbacks on the protocol of early warning to improve it further. This work process itself helped strengthen the capacity of relevant authorities and was consistent with Brazil's needs.

In addition, three municipalities selected as the pilot project sites have experienced sediment disasters and, hence, considered high priority areas in disaster risk management. Blumenau City developed its warning system called *AlertaBlu* before this project and had a strong interest in disaster risk management and a long track record. Rio de Janeiro State has a civil defense school that provides the country's municipal governments with disaster reduction training. By allowing such an organization to participate in the project's activities, it is expected that project

[3] The formulation of the *PPA* (2016-2019) was in process when the project commenced. Therefore, in a sense, it can be said that this project was reflected in the *PPA*.

outputs can be disseminated within the country. Based on the above, the selection of the project sites is considered appropriate.

At the ex-post evaluation, questionnaire surveys were sent to four federal implementing agencies and other relevant organizations. Interviews were also conducted with officials of all concerned organizations. The results showed that the project was consistent with the needs and expectations of concerned agencies and was highly evaluated.

3.1.3 Consistency with Japan's ODA Policy

Japan's aid policy to Brazil (as mentioned in the Official Development Aid [ODA] Data Book by Country 2013) listed "urban issues and environmental/disaster risk management policy" as a priority for Japan's assistance to Brazil. The project was a main operation of the natural environmental risk reduction program within the disaster risk management agenda, and consistent with Japan's ODA policy.

3.1.4 Appropriateness of Project Design and Approach

The project's counterparts (hereinafter referred to as "C/P") on the Brazilian side consisted of the staff of a number of institutions, i.e., federal government organizations and the authorities of pilot states and municipalities. The project involved many organizations in the implementation in this way and was designed to have a wide range of outputs, including: (1) capacity strengthening for hazard identification and risk assessment on sediment disaster; (2) capacity strengthening for planning based on the sediment disaster risk assessment; (3) improvement in the protocol of early warning, risk information dissemination, and disaster data collection; and (4) improvement in the monitoring and prediction system to mitigate sediment disasters. These outputs are indispensable components for establishing a management system of sediment disaster risks and need to be functional to achieve the project's overall goal of disaster risk reduction. Therefore, achieving all outputs with a short period of four years and five months was a major challenge. Furthermore, the disaster risk management which aims to produce these outputs requires an institutional structure where the operation is implemented in coordination among all concerned organizations. At the formulation stage of this project, it was decided that the project pursues an implementation structure that enables participating organizations to deepen mutual understanding and work in coordination through holding frequent meetings. Such a collaborative operational structure was unprecedented for all concerned agencies in Brazil, and therefore, was very substantial in itself.

Based on the above, the project was well in line with Brazil's development policies and development needs, as well as Japan's aid policy. Therefore, the relevance of the project is high.

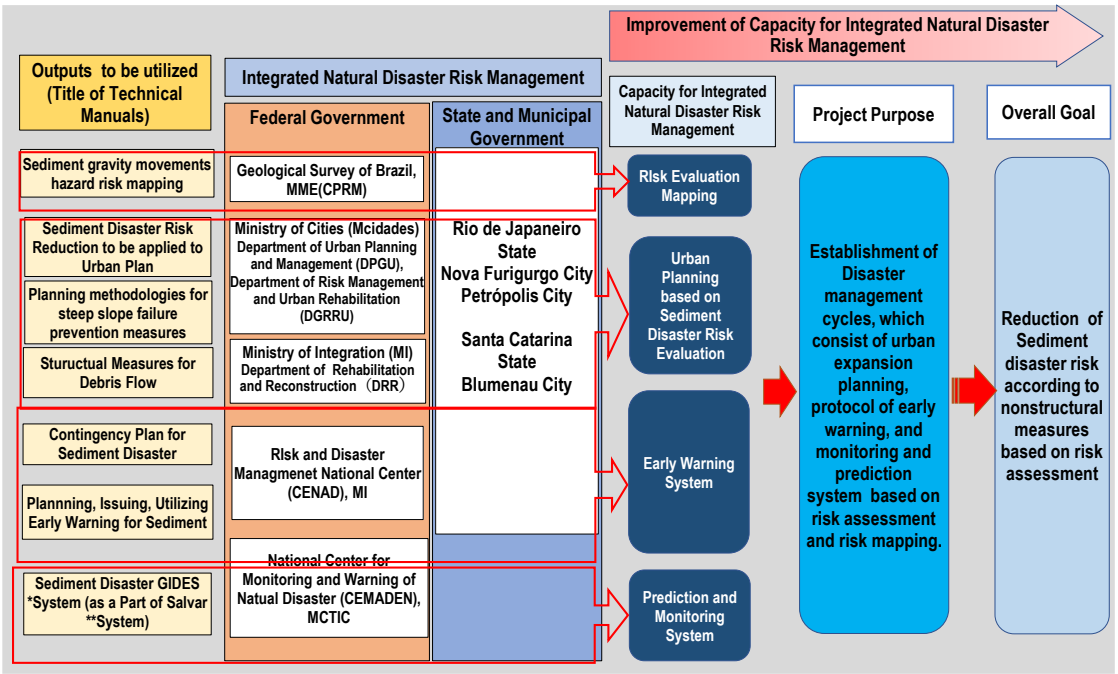
3.2 Effectiveness and Impact[4] (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Achievement of Project Purpose

The project outputs were mostly achieved by the time of the terminal evaluation. Therefore, the project purpose is considered achieved.

The indicators of the four project outputs were generally completed by the time of the terminal evaluation. The indicators considered almost completed or partially completed at the terminal evaluation were marked completed in the project completion report. These outputs covered the capacity strengthening in the following four areas: (1) improvement in risk assessment capacity of sediment disasters; (2) improvement in planning capacity based on sediment disaster risk assessment; (3) improvement in the protocol for issuing early warnings, disseminating risk information, and collecting disaster data; and (4) improvement in the monitoring and prediction system for sediment risk reduction. The relationships between outputs for each area, such as manuals, and capacity building of concerned C/Ps are summarized in Figure 1.



Source: Created by the Evaluator based on various JICA resources, including the project design matrix (PDM) of this project.

Notes: * GIDES is an abbreviation of this project's name in Portuguese (Gestão Integrada de Riscos de Desastres).
**CEMADEN's Risk Area Alert and Visualization System (Sistema de Alertas e Visualização de Áreas de Risco: Salvar)

Figure 1: The Logic Flow and Concerned Organizations of the Project

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

Source: JICA

Photo 1：Sediment Disaster Site in Nova Furiburgo City (2011)

Source： Blumenau City

Photo 2：Sediment Disaster Simulation Training in Fortaleza Alta, Blumenau City (2017)

Source： Petrópolis City

Photo 3： Monitoring Center at Civil Defense Bureau, Petrópolis City

Source： Petrópolis City

Photo 4：A landslide Site in Independência, Petrópolis City (2017)

With regard to various capacity building activities of the project, interviews were held with Japanese experts (two long-term experts and three members of consulting teams) and JICA staff who participated in the formulation and implementation of this project. According to their responses, the project has achieved capacity building of Brazilian C/Ps, as mentioned as the project's outputs. In addition, a questionnaire survey was conducted with all C/Ps (12 organizations/agencies) at federal, state, and pilot municipal governments. To supplement their responses, online interviews were also held with a total of 31 pertinent staff,[5] including more than one C/P from each organization. All respondents from the Brazilian side expressed that the capacity of C/Ps has been enhanced due to the project. Their comments about actual examples of capacity improvement are summarized in Table 1. Through the process of producing manuals,

[5] Interviewees were selected based on the recommendations from the staff at JICA Brazil Office, JICA staff that participated in the formulation and implementation of the project, former JICA experts, contact persons at Brazilian C/Ps during the ex-post evaluation study and other contacts at C/Ps to ensure that appropriate personnel would be interviewed.

participating in workshops, and receiving instructions from the Japanese experts, C/Ps obtained new knowledge and learned to apply it to their operations. The staff of these organizations and Japanese experts both highlighted that, by working together to produce manuals and participating in the same training program in Japan, away from their organizations, the staff of federal, state, and municipal authorities strengthened the coordination among them in addition to enhancing the technical capacity of their respective field. The fact that the staff of three different levels of administrations learned from each other through participating in various activities together was significant. Such an achievement was made possible by the highly motivated and mutually cooperative working relations among C/Ps, and Japanese experts and consultant teams during the project implementation.

Table 1: Views of C/Ps on the Achievement of Capacity Building

Topics	C/P	Capacity Building-related Outputs (mostly completed at Project Termination, but also include some progress made later)
Risk Assessment on Sediment Disasters	CPRM	✓ Improved geologic risk analysis and risk assessment of sediment gravity movements. ✓ Experience in conducting a risk assessment for each pilot project site and review of existing data collection and analysis methodologies. ✓ Developed a methodology to identify the origin and reach areas of a sediment disaster during the analysis process.
	Governments of Pilot Municipalities	✓ In Blumenau City, the municipal government incorporated the sediment gravity movement risk/hazard maps, produced under the project, into a decree (Decreto 12227/2019). Some geologists at the municipal government applied the hybrid approach of mapping technology, with partial incorporation of the method introduced by the project and conducted risk assessments in areas vulnerable to debris flow in the municipality. ✓ The staff of the Nova Furiburgo Municipal government strengthened their capacity for risk mapping preparation and evaluation with the help of CPRM. A new Geography Sector Unit was established within the Municipal government.
Formulation and Implementation of Urban Expansion Plan and Disaster Prevention, Rehabilitation, and Reconstruction Plan	MDR (MCidades and MI during Project Implementation)	✓ Planning based on disaster risks (e.g. zoning incorporating risk assessment), review and improvement of planning methodologies for steep slope failure prevention measures and debris flow mitigation. ✓ Strengthening capacity for planning and implementing disaster prevention activities for disaster risk reduction by knowledge and experience obtained through technical meetings in training in Japan and Brazil. ✓ Brazil already had a slope failure manual created by GEO-Rio Foundation in Rio de Janeiro, and thus the project was supplementary in this area. But there was no know-how on how to conduct risk mapping of or respond to debris flows in Brazil. Therefore, the project provided new knowledge related to debris risk.
	Governments of Pilot Municipalities	✓ In Blumenau City, the risk assessment map, developed under the project, contributed to the formulation of its Urban Master Plan, approved in 2018 (However, because of zoning codes that were later established, there is a need for another plan that is more detailed and reflective of risks). ✓ Nova Furiburgo City strengthened capacity to develop a plan for disaster risk reduction, implement risk reduction, mitigate risks, and take countermeasures. ✓ Although the project did not include urban planning in its scope in Petrópolis City, discussions on making laws and regulations on land use and occupation maters have started, and people's awareness of the topic has grown.

Protocol of early warning	CENAD	✓ Methodologies and procedures of developing a contingency plan (emergency response plan at the time of disaster) and early warning of sediment disaster. ✓ One of the important lessons was to gain a practical understanding of the relations between the warning levels and civil defense action. ✓ Continued consultation with concerned organizations/agencies after the project termination on sediment and flood disasters caused by heavy rainfalls. There is a plan to improve procedures and protocol for early warning in 2021.
	CEMADEN	✓ Through exchanges of opinions with state and municipal staff, clarified how CEMADEN's warnings were interpreted by them and understood how agencies in charge of disaster prevention on the municipality level would react to warnings. ✓ The Japanese warning system introduced under this project considerably improved the quality of warnings, especially in terms of speed, accuracy, and automation of issuing early warnings for precipitation events. A lesson learned from the project is that Brazil will need to find a way to incorporate weather forecasts into Japan's system, and this is a remaining challenge.
	Governments of Pilot Municipalities	✓ Blumenau City developed its own early warning system, called *AlertaBlu*, two years prior to the start of this project. The new information dissemination procedures and a protocol were added to this system. The city also created the precautionary advisory stage to rainfall monitoring (Other municipal governments also supported improving precautionary advisories). ✓ Petrópolis City elaborated further the protocol of early warning system based on the proposal by the project, since they were in the process of installing additional sirens to expand the coverage of their early warning network. By working with a private service provider, the city selected appropriate locations for siren installation.
The Monitoring and Prediction System	CENAD CEMADEN	✓ CEMADEN incorporated the system developed under the project into Brazil's existing *Salvar* system and started real-time monitoring of the precipitation data, which is transmitted from the rain gauges installed in municipal governments to CEMADEN, to ensure rainfalls will not exceed the threshold level. ✓ All concerned organizations/agencies agreed on the operational challenge related to coordinating the (disaster) events database, which is shared by various organizations, such as CEMADEN, CENAD, and CPRM.

Sources: JICA resources, questionnaire responses collected from implementing agencies, and information collected during interviews with relevant staff ofimplementing agencies and Japanese experts.

Notes: *Governments of pilot municipalities: state government of Rio de Janeiro, municipal government of Nova Furiburgo, municipal government of Petrópolis, state government of Santa Catarina, and municipal government of Blumenau.

In light of the above outputs, Project Purpose was considered achieved as listed in Table 2. During the project, three levels of government agencies, i.e., federal, state, and municipal, consulted to formulate a set of manuals as part of project outputs and utilized them as national guidelines. This experience has set the foundation for the three levels of governments to continue discussions in the future. Judging from the interview responses of concerned parties, the awareness about the importance of mainstreaming disaster risk reduction among federal, state, and municipal agencies was high at the time of project termination.

Table 2: Achievement of Project Purpose

Project Purpose	Indicator	Actual
Disaster management cycles, which consist of urban expansion planning, protocol of early warning, and monitoring and prediction system are established based on risk assessment and risk mapping.	1. Methodologies and procedures for risk assessment on sediment disaster are approved with the CPRM and related organizations. 2. Tools and plans for urban expansion planning and reconstruction are approved with related organizations. 3. Methodologies and procedures for issuing early warning of sediment disaster are incorporated in the national system of forecasting and early warning.	**Achieved** 1. One of the project's indicators, "Methodologies and procedures for risk assessment on sediment disaster," were approved by CPRM and related organizations. CPRM uses them as one of the criteria for risk assessment on sediment disasters. 2. Manuals on Urban Planning and Sediment Disaster Risk Reduction, Plan Preparation for Slope Rapture Countermeasures, and Plan Preparation for Debris Flow Countermeasures were approved by the then MCidades. These manuals were uploaded on the MDR's website* and can be downloaded by anyone. 3. Recommendations provided under the project on the methodologies and procedures for issuing early warning on sediment disasters have been incorporated in the systems of CEMADEN, CENAD, and state and municipal governments of pilot project sites. ・ Although not included in the project's indicators, the manual on contingency planning of sediment disaster was approved on December 5, 2018, as MCidades' ministerial ordinance No. 348. ・ The project's outputs, such as methodologies, and procedures for risk assessment and issuing early warning on sediment disasters, and all related manuals were disseminated among C/Ps, and through them, in the respective organizations.

Source: JICA resources, questionnaire responses collected from implementing agencies, and information collected during interviews with relevant staff of implementing agencies and Japanese experts.
Note: * The website https://antigo.mdr.gov.br/protecao-e-defesa-civil/publicacoes/293-secretaria-nacional-de-protecao-e-defesa-civil/11876-projeto-gides (as of July 2021).

This project mostly achieved the following four capacity building outputs: risk assessment, development and implementation of urban expansion planning as well as the disaster prevention/rehabilitation/reconstruction plans, early warning protocol, and monitoring and prediction system. These outputs were incorporated in the operations of each concerned organization, and a set of manuals for each topic has been developed, as planned, through the concerted efforts of Japan and Brazil. Pertinent government organizations approved these manuals. The Project Purpose has been achieved, and therefore, the effectiveness of this project is high.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

The Overall Goal is being partially achieved. It will take some time for the non-structural measures, which incorporated the risk assessment provided in the project, to be reflected in the urban expansion plans, but they are reflected gradually in the municipal disaster risk reduction plans.

The indicator for the Overall Goal described in the PDM, i.e., incorporating the project's outputs in the *PPA*, is partially achieved as explained in Table 3.

Table 3: Achievement of the Overall Goal

Overall Goal	Indicator	Actual
Sediment disaster risk is reduced according to nonstructural measures based on risk assessment.	1. Next version of the Multi-Year Plan is formulated considering the outputs of the Project.	**Partially achieved** 1. In the federal government's *PPA* (2020-2023), the budget for disaster risk management was listed as *Program 2218: Disaster Risk Management Program (Civil Defense).* Compared to the *PPA* (2016-2019), the provision is mainly focused on civil defense activities (i.e., early warning issuing, evacuation, disaster rehabilitation/reconstruction) and is more limited in scope.
	2. Priority actions following the revised version of the plan are implemented.	2. In 2020, the implementation of various government programs was postponed due to the widespread transmission of COVID-19 in Brazil. The programs related to disaster risk management were also impacted, and priority actions based on the *PPA* have not been implemented.

Source: JICA resources, questionnaire responses collected from implementing agencies, and related agencies, and information collected during interviews with relevant staff.

The incorporation of project outputs in the plans formulated by the federal government means more than the incorporation in the *PPA*, one of the indicators for the project's Overall Goal. Therefore, the ex-post evaluation study also investigated whether outputs were incorporated in other federal government plans. According to the MDR, the project implementation period overlapped with the formulation of the *National Urban Development Policy (Política Nacional de Desenvolvimento Urbano)*. The contents discussed under the project have been incorporated in this Policy and are being implemented.

In addition, because not only the *PPA* of the federal government but also local governments are in charge of the planning and implementation of disaster risk management when verifying the achievement of the Overall Goal, it is crucial to confirm whether the project's outputs were incorporated in the plans developed and implemented by local governments. With regard to incorporating project outputs in the plans by local governments of pilot municipalities, the following areas have advanced towards risk reduction through non-structural measures.

- ✧ According to the C/P within the state government of Rio de Janeiro and the State Civil Defense within the state government of Santa Catarina, the project's outputs were reflected in the *Emergency Response Plan for the State of Rio de Janeiro* and the *Disaster Risk Reduction and Management Plan of the State of Santa Catarina*.
- ✧ According to the relevant staff in the three pilot municipalities, the project's outputs were used as a reference during the formulation and review of their Disaster Risk Reduction and Management Plans.
- ✧ The contingency plan developed by the project for the communities with high sediment disaster risks in pilot municipalities and the revised protocol of early warning can lead to reduced disaster risk.

The *Manual for Urban Planning to Apply Sediment Disaster Risk Reduction to be Applied to Urban Expansion Planning* needs to be reflected on each city's Urban Master Plan of each municipality. The work is underway for obtaining formal approvals and implementing Urban Master Plans, which incorporates the macro-zoning based on risk assessment conducted under the project. Interviews were held with relevant pilot municipalities (with staff in charge at such offices as the Civil Defense Bureau, Urban Planning Bureau) during the ex-post evaluation. In Blumenau City, the risk assessment map produced under the project contributed to developing their Urban Master Plan approved in 2018. However, there is a need for the city to apply more detailed zoning codes reflective of the degrees of risk to the planning process. The decree on land use/occupation promulgated in 2019 included the risk assessment map produced under this project as an attachment. In Nova Furiburgo City, the project's outputs were considered when the macro-zoning was reviewed in the city's urban and rural areas in December 2019. However, unlike the case of Blumenau City, the revised decree on land use/occupation has not reached the approval process by the legislature at the time of the ex-post evaluation. The situation is similar in Petrópolis City. All municipalities appear to need more time to formulate and approve master plans that reflect the degrees of risk and project outputs in greater details.

The hazard and risk assessment information on sediment disaster developed under this project is used as the basic information for studying how to reduce sediment disaster risks through structural measures under the subsequent project, "Capacity Development Project for Structural Measures against Sediment related Disaster for Resilient Cities."

3.2.2.2 Other Positive and Negative Impacts

Other impacts of this project were confirmed as follows:

(1) Improved Coordination and Cooperation among Four Federal Organizations, Pilot states and Municipalities in Disaster Risk Reduction Activities

According to Japanese experts and C/Ps' self-evaluation, the project contributed to raising the recognition for the need to collaborate among various relevant government organizations on three administrative levels (federal/state/municipality) on disaster risk reduction, and the importance of risk prevention activities for sediment disaster risks. Concerned organizations and agencies of this project maintained cooperation during the project implementation, and that experience strengthened the awareness among relevant staff of its need and importance.

The international society also recognized this coordination structure. At the "2017 Global Platform for Disaster Risk Reduction," organized by The United Nations Office for Disaster Risk Reduction (UNDRR) in Cancun, Mexico, this project received the UN Sasakawa Award for Disaster Reduction on May 25, 2017. The favorable evaluation was given as the project strengthened the lateral coordination among concerned government agencies in taking risk management measures for sediment disasters. Such coordination among organizations was rarely seen in Brazil in the past, and the project was regarded as an example of good practice. The reward was used to cover part of the printing expense of the manuals produced in the project.

The coordination structure, seen during the project implementation, was maintained through meetings of concerned parties for a while after the project termination. However, meetings have not been held for the last few years and the coordination structure was not continued. Concerned organizations expressed their views that similar meetings as held during the project are needed.

(2) The Dissemination of Project Outputs inside Brazil

After the project termination, CPRM and the state government of Santa Catarina entered into an agreement to conduct hazard and risk assessment in five municipalities in the State. Using one of the project outputs, *Hazard and Risk Mapping Manuals for Sediment Disaster,* CPRM and the state government developed the sediment disaster hazard and risk assessment maps for the five municipalities. In 2021, CPRM plans to conduct hazard mapping of three more municipalities (one area each from the South, Southeast, and North regions). In 2019, CENAD, CPRM, and CEMADEN also provided training to Secretariat of Civil Defense in the State of Pernambuco on the methodologies developed in the project.

The State of Rio de Janeiro also secured the budget for risk assessment and mapping in 2019, although the implementation has been delayed at the time of this ex-post evaluation. The plan is to conduct risk assessment mapping in some priority areas, using the mapping methodologies provided in the project.

(3) Contribution to Research on Sediment Disaster Risk

According to CPRM, eight research papers were completed on the hazard and risk mapping for sediment disasters based on the project activities and outputs (as of February 2021). Furthermore, after the project termination, a C/P of CPRM spoke about this project at an event, "10 years of Rio de Janeiro Mountain Regions Mega Disasters," organized by the Brazilian Geological Society on January 14, 2021. Thus, the project is considered to have had some positive impacts on the research in this field inside Brazil.

(4) Participation of the Japanese Private Enterprises in the Market of Brazil

To solve the challenges, which came to light during the project implementation, three new public-private partnership assistance programs were formulated. Under the project "Disseminating Radar Rain Gauge in Paraná State (2017-2019)" JICA collaborated with Japan Radio Co., Ltd. to improve the accuracy of rainfall measurement in urban areas and facilitate the transmission of early warning. A weather radar capable of measuring rainfall intensity more accurately was installed in Curitiba City, Paraná State. As for structural measures, JICA collaborated with the Nippon Steel Metal Products, Co., Ltd under the project "Steel, Slit Dam and Sabo Soil-cement Gravity Dam (2017-2019)" to promote the construction of a steel Sabo dam in an area with high debris flow risks in Nova Furiburgo City, one of the pilot sites of this project. In collaboration with Remote Sensing Technology of Japan (RESTC), JICA is implementing the project "Establishing a Basic Map for Risk Assessment Using Satellite-based Digital Maps (AW3D)" (planned for 2019-2021)" to help develop a basic map from the satellite images for pilot project sites (i.e., Nova Furiburgo City Petrópolis City, Blumenau City). The basic maps will then be used to analyze disaster risks.

(5) The Spill-over Effects of Project Outputs on Other Aid Agencies

During the ex-post evaluation, a C/P of MDR mentioned the "Sustainable Urban Development Project in Brazil (Apoio à Agenda Nacional de Desenvolvimento Urbano Sustentável no Brasil, hereinafter referred to as "ANDUS")," provided by the German Corporation for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit ：GIZ), as an example of this project's positive impacts on the assistance by other aid agencies. According to this C/P, the project concept of ANDUS was proposed to MDR during the last year of this project's implementation. This C/P staff mentioned the project's experience, particularly how beneficial the cooperation and exchange of ideas with pilot municipalities were. As a result, ANDUS incorporated a similar implementation structure. In a publication titled the Guidelines for the Formulation and Reviews of the Urban Master Plan (Guia para Elaboração e Revisão dos Planos Diretores), published under ANDUS at the end of 2019, a manual produced under this project

was used as a reference for the development of the Disaster Risk Reduction Plan for Municipality (Plano Municipal de Redução de Riscos).

One indicator for this project's Overall Goal, "Sediment disaster risk is reduced according to nonstructural measures based on risk assessment," is that the incorporation of the project outputs into the "Disaster Risk Management and Response Program" of the current version of the *PPA* (2020-2023) is only related to the part of the civil defense. It is critical that the project outputs are also incorporated into the plans of the local governments. Although more time is needed to reflect the results of risk assessment in the regulations related to land use and Urban Master Plans of all pilot municipalities, the project led to the improvement in disaster risk reduction plans, evacuation action plans, and early warning protocol of targeted communities in pilot municipalities. Based on the above, the overall goal is considered partially achieved. The project also yielded a wide range of other positive impacts, including: improved coordination and cooperation for disaster risk reduction activities among four federal government organizations and pilot state and municipal authorities; recognition given by the UN Sasakawa Award for the collaborative structure; formulation of new JICA collaboration programs with the private sector; application of methodologies of sediment disaster risk evaluation and mapping to non-pilot municipalities; contribution to the research on sediment disaster risks; and impacts of the project outputs on another aid agency. The achievement of the overall goal is in progress, and the project had various other positive impacts. Therefore, the impact of the project is considered high.

This project has achieved the project purpose of "Establishment of disaster management cycles, which consist of urban expansion planning, protocol of early warning, and monitoring and prediction system based on risk assessment and risk mapping" and the overall goal in terms of incorporating project outputs into federal and local government plans and implementation of planned activities, having other various spill-over effects. Therefore, effectiveness and impact of the project are high.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

The planned and actual inputs on the Japanese side are summarized in Table 4. At the ex-post evaluation, questionnaire surveys and interviews were conducted. The Brazilian C/Ps highly valued the quality of Japanese experts and training programs in Japan.

Table 4: Inputs of the Project

Inputs	Plan	Actual
Dispatch of experts	Long-term experts ・ Chief Advisor/Disaster management policy (48 months) ・ Erosion and sediment control (24 months) ・ Coordinator (48 months) etc. Short-term experts ・ Sediment risk evaluation and hazard mapping ・ Forecasting and early warning ・ Land use regulations and development planning ・ Disaster prevention and recovery planning ・ Flash flood ・ Meteorology	Long-term experts: 6 experts ・ Chief Advisor/Disaster management policy ・ Erosion and sediment control ・ Coordinator Short-term experts: 8 experts ・ Forecasting and early warning ・ Sediment risk evaluation and hazard mapping ・ Disaster prevention and recovery planning Consultant Team: Survey phase – 8 consultants Manual preparation phase–11 consultants General Manager (sediment disaster), Organization and legal system, Disaster data, Risk assessment and mapping, Urban planning/land use regulations/development planning, Disaster prevention/rehabilitation/reconstruction planning, Early warning and risk information dissemination, Sediment disaster monitoring, Prediction system
Training	Training in Japan and a third country	71 trainees (5 trainings in Japan)
Provision of equipment	Office automation equipment, analysis software, etc.	Laptops, laser range finder, laser printer
Local activity cost (local cost)	Expenses related to organizing seminars, workshops, OJT	Part-time staff, domestic trip expenses, communication expenses, etc. Approximate total JPY137 million
Total project cost (Japanese side)	JPY907 million	JPY1.1 billion

Source: JICA documents

3.3.2 Elements of Inputs

3.3.2.1 Project Cost

The actual project cost was JPY1.1 billion against the planned project cost of JPY907 million, representing 121% of the planned cost. One of the reasons for the cost overrun was an increase in the number of C/Ps, from 21 persons scheduled at the signing of R/D to 77 persons and therefore this resulted in the increased number of participants for training in Japan (71 participants).

3.3.2.2 Project Period

The project period was divided into four phases: survey, manual preparation, pilot projects and manual review, and conclusion. The project period was planned to be four years, but was

extended to four years and five months, which is 110% of the plan. The project experienced a delay as early as the Plan of Operation (PO) preparation stage in the survey phase. The main reasons for this delay were the political turmoil created by the presidential impeachment trial in 2016, difficulties securing appropriate staff due to mayoral elections in local areas, and the lack of an adequate operational budget. These external factors were considerable setbacks and hindered the timely implementation. In the first half of the project period, especially in FY2016, the progress was stagnant, but efforts were made in the latter half of the year, and the project was implemented as scheduled.

Brazilian C/Ps and Japanese experts often pointed out that the implementation arrangements, including the frequently organized Joint Technical Working Group (JTWG) meetings, enabled the efficient implementation of the project. Conducting the meetings of C/Ps located in different areas online was instrumental for the efficient implementation.

The implementation of this project involved a wide geographical area and many implementing agencies. These factors put a load on the management of this project and increased the risk of implementation delays. Moreover, the political turmoil caused by the presidential impeachment turned out to be a major obstacle.[6] It is worthy of notice that the project extension was limited to 5 months,[7] and project outputs and purpose were mostly achieved despite adverse impacts. The factors that contributed to the project implementation, such as the above-mentioned implementation arrangement, are listed below:

- Key role played by JICA staff and Project Coordinator in formulating and implementing the project

Both Brazilian C/Ps and Japanese experts highly commended the tireless efforts of the JICA staff engaged in the formulation of this project and the excellent project management capability of the project's Coordinator. The JICA staff continued to get involved in project implementation, either as the staff in charge or a supervisor when he was transferred to different positions (Brazil Office, Latin America and the Caribbean Department, Global Environment Department) during the project period. He also promoted the formulation of collaboration programs with private sector to support the implementation of this project. Having the staff, who was involved in the

[6] The then President Rousseff was accused of manipulating the government budget and was removed from office at the end of August 2016 due to the Senate vote in the impeachment trial. The impeachment trial started at the end of 2015, and the Senate suspended President Rousseff's power and duties in May 2016. Considering that for approximately eight months from the end-2015 to the end of August 2016, there were repeated anti-government demonstrations by the people, and that the society was in turmoil, it was likely that the government's internal processes were stranded on various levels. The implementation of this project is considered to have been substantially affected as well. The long-term experts mentioned that the federal budgets were unavailable during this time, and it was listed as one of the main reasons for the project delay at the project's terminal evaluation.

[7] To be accurate, a few interviewees have mentioned that the extension of the project was considered in the final year of 2017, but did not materialize due to a lack of funding available on the JICA side. The project extension may have been a preferred direction if achieving outcomes and Project Purpose in a more complete manner was the aim. However, outputs and Project Purpose were largely achieved in accordance with indicators. It is worth noting that some efforts were made to reduce the impact of the implementation delay caused by political and other factors.

formulation of the project and was knowledgeable about it, continued to support helped, in no small measures, to facilitate the smooth project implementation. This JICA staff's contribution was highly valued by the federal government and resulted in the award of the National Civil Defense Decoration.[8] As for the project's Coordinator, he tactfully arranged conferences in a manner that Brazilian organizations could take the initiative. In response to the frequent staff changes in the federal government organizations, especially on the high levels, the Coordinator actively reached out to the new personnel to promote their understanding of the project. Such day-to-day operational coordination was crucial for promoting implementation.

- Selection of high-caliber Japanese experts

The Japanese experts and consultant teams dispatched under the project included professionals who were active on the frontline in sediment disaster risk management in Japan, such as officials of the National Institute for Land and Infrastructure Management under the Ministry of Land, Infrastructure, Transport and Tourism. Engaging highly qualified experts likely contributed to enhancing the effectiveness of the project and the efficiency of implementation. According to the JICA personnel at the time of project formulation and the project's Coordinator, it was considered necessary to dispatch Japanese experts with the solid technical ability to respond to the high technical levels of researchers at Brazil's federal government organizations. Therefore, the selection of experts was conducted with attention to this point. Furthermore, care was taken to ensure that there would be an adequate number of capable translators, who played an essential role in facilitating the communication between Japanese experts and Brazilian C/Ps.

- Capability and Commitment of Brazilian C/Ps

One of the promoting factors for this project was the high qualification and strong commitment of the researchers at Brazilian concerned organizations. In addition to those with master's or doctorate degrees, many had studied in western countries. The project scope that fit each C/P's capacity strengthening needs and dispatching capable Japanese experts as mentioned above were other factors that ensured C/Ps' willingness and commitment to project activities.

Although the extension of the project period was limited to a minimum, both the project cost and period exceeded the plan to an extent. Therefore, the efficiency of the project is fair.

[8] JICA website https://www.jica.go.jp/topics/2018/20190328_02.html (as of July 2021)

3.4 Sustainability (Rating: ②)

3.4.1 Policy and Political Commitment for the Sustainability of Project Effects

The below evidence shows that the project is sustainable to some extent from the policy and political points of view. However, considering the political influences, this category is rated fair.

- As analyzed in 3.2.2.1 Achievement of Overall Goal, the *Program 2218: Disaster Risk Management (Civil Defense)* in the federal government's *PPA* (2020-2023) mentioned the budget for capacity building of municipal governments for disaster response and disaster risk reduction. This program supports risk assessment and mapping, disaster risk reduction plans in municipalities, geotechnical maps for urbanization suitability, contingency plans, and the early warning system. Thus, there are continued efforts that are related to the project's outputs. However, compared to the previous *PPA* (2016-2019), the program content was considerably reduced and only the civil defense-related program was maintained within disaster risk management. It is not always required to maintain the same level of content and budget, however, there was a change in administration in Brazil in 2019, and the priority given to disaster risk management within the overall federal government plan is not necessarily equal to that under the *PPA* (2016 – 2019), affected by political influences.

- On the other hand, plans of some government organizations include activities that reflect the project outputs and allow the continuation of activities started under this project. For example, CPRM's internal activity plan shows that the organization will conduct hazard mapping. Also, CEMADEN's Master Plan (approved in 2019) shows that the warning and monitoring of sediment disasters will be conducted based on the model developed under the project.

- The Disaster Risk Reduction Plans on state and municipality levels refer to this project (GIDES). However, incorporating the sediment disaster risk assessment to land use regulations and Urban Master Plans of each municipality will likely require more time because there are often vested interests of local people and it is not easy to obtain the approval of the municipal legislature.

- In Brazil, combating the COVID-19 pandemic has been a more urgent agenda since 2020.

3.4.2 Institutional/Organizational Aspect for the Sustainability of Project Effects

Considering the situations related to the legal and the institutional systems, institutional/organizational aspect of the sustainability of project effects is rated fair.

〈Legal System〉

- Based on Regulation No. 10593 of Law No. 12608 (December 2020), the National Civil Protection and Defense System, Civil Defense Council, Civil Protection Plan, and National Disaster Information System were established as part of the country's Disaster Risk Management System.
- The protocol of early warning, developed through the consultation among federal, state, and municipal authorities under this project, was introduced by CEMADEN, CENAD, and all pilot states and municipalities.

〈Organizational System〉

- After the project termination, meetings were organized less frequently and the collaborative system among federal, state, and municipal governments was discontinued. All C/Ps expressed their views that continued collaboration is needed. The reason why the collaborative system did not continue was due to the reorganizational and personnel changes of each organization, however, it can be mentioned that another reason is that there was no project activity to establish a sustainable system for the post-project period that takes these risks into consideration.
- Among the federal government organizations, MI and MCidades were merged as MDR in January 2019. This reorganization made it possible to unify their activities, which used to be conducted by separate ministries. Also, the Department of Disaster Management and Coordination and the Department of Risk Management were established within CENAD. On the other hand, urban planning-related sections have seen staff reductions. Nevertheless, C/Ps strive to share the project's outputs within their respective organizations, and therefore, the sustainability of project effects has not been jeopardized.
- In state and municipal governments, a change in the governor or mayor often results in personnel reshuffling. During this ex-post evaluation, two state governments and three municipal governments were contacted to check the status of C/Ps. As a result, it was confirmed that, even when an original C/P was transferred or chose to resign, there is another staff who is engaged in the same task since the project implementation or a different disaster-related operation. Hence, the project's outputs were passed on among staff.

3.4.3 Technical Aspect for the Sustainability of Project Effects

The technical aspect for sustainability is considered high due to following reasons:

- The whole set of manuals, a part of project deliverables, can be found on the MDR website and available even after personnel changes. The content of the manual for risk evaluation has been reviewed by members of the Society of Technology, Environment and Geology in Brazil and domestic consultants (including university professors and others). The C/Ps in MDR confirmed that these manuals were shared with colleagues in his department. Some Brazilian C/Ps and Japanese experts mentioned that it would have been better if researchers, such as those noted above, were included in the project activities from the start.

- According to the feedback received in the meetings with C/Ps, the technical manuals that were part of the project's outputs continue to be used by all organizations. For example, the response from the federal agency in charge of urban planning showed that they refer to the manual when they receive inquiries from municipalities.

- The technical knowledge (e.g., risk assessment and mapping, early warning and risk information dissemination), which the federal government staff has obtained during the project, is being applied in different regions in the country.

- CENAD approved and is implementing the training plan (2019-2023) aimed at the Civil Defense Bureaus at state and municipal governments. Among the training programs offered is the one called "GIDES," the title of this project. This program provide training on the contingency plan for sediment disasters, which was proposed in this project.

- CEMADEN was supposed to apply the proposed methodology for issuing early warning to its system after the project termination. As of the time of ex-post evaluation (a meeting in January 2021), it has not happened, but the monitoring methodology that was developed in the project is now technologically ready to operate. In addition, CEMADEN, in cooperation with CENAD, has a plan to offer virtual training to the Civil Defense Bureau in each municipality on how to use the federal government's early warnings.

- The federal government expressed that it intends to refer to the Manuals on Plan Preparation for Countermeasures to Sediment Disasters for design, construction management, and fund management when it receives the construction application from state and municipal authorities. Further, related to such structural measures, JICA's collaboration program with the private sector is in progress to construct a Sabo dam,

based on Japanese technology, in Nova Furiburgo City (the project "Steel, Slit Dam and Sabo Soil-cement Gravity Dam" Nippon Steel Metal Products, Co., Ltd). In addition, this project's follow-up technical cooperation project, "Capacity Development Project for Structural Measures against Sediment related Disaster for Resilient Cities," aims to support pertinent Brazilian staff to gain knowledge and improve technologies related to disaster countermeasure constructions.

- Each concerned organization retained at least one staff who participated in the preparation of manuals under this project and gained new knowledge. The knowledge is thus still being shared within the respective organizations after the project completion. Therefore, project outputs are being passed down at least to some degree.

3.4.4 Financial Aspect for the Sustainability of Project Effects

As will be mentioned below, the overall federal budget for disaster risk management decreased, but the budget for training, which is beneficial for promoting the utilization of the project outputs, is provided. The budget for the Civil Defense Bureau of each pilot city continued to be allocated at a constant level. Therefore, the sustainability from the financial aspects is rated fair.

- As investigated in 3.2.2.1 "Achievement of Overall Goal," the budget of the federal government for disaster risk management related programs was decreased from BRL4.1 billion to BRL1.87 billion in the ongoing *PPA* (2020-2023). MCidades and MI were merged into MDR and went under a broad organizational reform. As a result of interviews with MDR officials, it was confirmed that MDR's disaster response-related budget was significantly reduced. Nevertheless, the *PPA* is not the only institution that reflects the project's outcomes. As mentioned in 3.4.3, CENAD, which is in the forefront of utilizing the project's outcome (GIDES system), has been receiving the budget for training purposes.

- The budget for civil defense bureaus on the state and municipal levels did not experience much change. In Nova Furiburgo City, a new budget law introduced budgetary items for various programs related to natural disaster risk management programs in October 2019. In addition, with regard to risk assessment, Rio de Janeiro State and Santa Catarina State provided a budget to conduct risk assessments in other areas in their states. Santa Catarina State has already started the risk assessment operation. On the other hand, it was reported that the budgets for urban planning and construction work within MDR decreased.

- In Brazil, the widespread COVID-19 pandemic since last year is an urgent challenge to be tackled. The budget has been allocated for disaster risk reduction and management, but the actual execution of related work may require some time.

Regarding policy and political commitments for the sustainability of project effects, the scope of the federal disaster risk management program has been reduced compared to the one during project implementation. However, project outputs are incorporated in disaster risk management plans on the state and municipal levels. Therefore, from the policy viewpoint, the project is partially sustainable. Related to the institutional aspect, the approval of Regulation No. 10593 of Law No. 12608 (December 2020) instituted the country's Disaster Risk Management System, and the protocol of early warning, proposed under this project, was adopted by all organizations involved in early warning. Concerning the organizational aspect, the collaborative structure that enabled regular consultations among the federal, state, and municipal authorities during the project implementation was not maintained after the project termination. Also, the three levels of governments all experienced some reorganization and staff decreases. However, these structural changes did not amount to a devastating impact that threatens the sustainability of project activities and outcomes. As for the technical aspect, the set of manuals produced in the project is made available to the public on MDR's website, and officials can refer to the manuals to work on their tasks. The protocols of risk evaluation and mapping, as well as early warning and disseminating risk information and other products, are being applied to other regions in the country. Therefore, the sustainability of the technical aspect is high. In terms of the financial aspect, the budget of the federal-level disaster risk management has decreased. Still, some funding was provided for the activities beneficial for the continuation and dissemination of the project's outputs, such as training programs for CENAD and dissemination activities for the project's outcomes.

The sustainability of project outputs has been mixed – some issues have been sustainable, whereas others have faced challenges. In light of the above, the overall sustainability is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project supports capacity building for the risk assessment on sediment disasters, formulating and implementing, based on such risk assessment, urban expansion plans and disaster prevention/rehabilitation/reconstruction plans, issuance of early warning and dissemination of risk information, and research and development on disaster monitoring as well as forecast and early warnings. Through capacity building activities, the project aims to improve Brazil's preparedness for disaster response and thereby contributes to strengthening its integrated national strategy for natural disaster risk management. This project is consistent with the needs of Brazil's

development plans and policies as well as the efforts made by the governments on federal, state, and municipal levels to prevent disasters. The project is aligned with the Japanese government's development aid policies of that time as well. Japan's advanced sediment disaster technologies also contributed to the project. In light of the above, the relevance of the project is high. The project delivered outputs related to capacity strengthening of pertinent organizations and agencies in four areas: risk assessment on sediment disasters; formulation and implementation of urban expansion plans as well as disaster prevention, rehabilitation, and reconstruction plans; protocol of early warning; and system of monitoring and prediction. The federal government officially approved manuals and other products of this project for these areas as the national guidelines to be referred in Brazil, and therefore, the effectiveness of the project is high. One of the verifiable indicators for the Overall Goal, i.e., project outputs will be reflected on the disaster risk management program in the *PPA* (2020-2023) at the time of the ex-post evaluation, was partially achieved. However, project outputs were incorporated in policies and training plans of federal government organizations and disaster risk reduction management plans of local governments. In addition, the project had many other positive impacts, including: raised awareness among federal and local authorities about the importance of coordination and cooperation for mainstreaming disaster reduction management; enabled the government to apply risk evaluation and hazard mapping to other locations; contributed to the research on sediment disaster risk in Brazil; led to the formation of JICA's new collaboration programs with the private sector; and had positive spill-over effects on other donor agencies. Therefore, the impact of this project is considered high. With regard to the efficiency, the delay in project implementation was managed within a minimal level, but the project has experienced some cost overrun and extension of the cooperation period. Therefore, the efficiency of the project is fair. Concerning the policy and political aspects of sustainability of project effects, the context as the federal government program has waned due to political influence and other factors; however, project outputs are partially incorporated in the activities of each federal government organization and the operations of local governments. As for institutional and organizational aspects, all project's products were enacted by federal and local authorities, but the collaborative institutional arrangement between federal and local governments, established under this project, is no longer functioning. The sustainability of technical aspects is high, as seen in the case of technologies mastered by participating organizations and agencies under the project. Concerning financial aspects, a certain level of the budget has been allocated by the federal government for training programs to disseminate project outputs and by municipal governments for disaster reduction activities. Considering the mixed results across aspects and organizations, the overall sustainability of this project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

Maintenance of Collaboration Structure among Federal, State, and Municipal Authorities: for Dissemination and Revision of Manuals

The close consultation and collaboration among federal, state, and municipal authorities during the project were listed as one of the factors for this project's success. As time passes after the project termination, however, these organizations ceased to convene all in one place as they used to do during the project implementation. The set of manuals that summarized project outputs will need periodic reviews through exchanging views and reconciling differences among concerned organizations. Therefore, it is desirable if meetings will be planned and held periodically among pertinent organizations of a specific topic in each area as soon as possible.

4.2.2 Recommendations to JICA

Organization of follow-up seminars

There were many requests from the Brazilian side for the project's follow-up activities. It is recommended to hold seminar or workshop to continue Japanese cooperation with disaster prevention policies in Brazil, including follow-up the project activities, together with the purpose of upgrading the technologies and further disseminating the project's outputs to the rest of Brazil, if feasible, at the appropriate time. Through these activities, JICA can follow up technological challenges which Brazilian C/Ps may find. They will also help disseminate the project's knowledge to the newly assigned staff of pertinent organizations. Therefore, the follow-up seminars and workshops will solidify more firmly the effects and impacts of the project.

4.3 Lessons Learned

Development of Project Scope and Implementation Arrangements based on the Long-term Strategic Support for the Country's Disaster Management Operations

This project put into practice many points proposed by lessons learned based on a cross-sectional analysis of evaluation reports "Public Administration on Disaster Prevention: Strategic Approach to Support for Disaster Risk Reduction (Basic Requirements)"[9]. One knowledge lesson from past projects about the strategic approach for disaster management recommends "developing a long-

[9] JICA Report "Thematic Evaluation− Cross-sectional analysis of evaluation results: Extraction of practical knowledge lessons in the field of disaster prevention" (2014)
https://www.jica.go.jp/activities/evaluation/tech_ga/after/ku57pq00001cdfnb-att/201412_01.pdf
(As of September, 2021). Only Japanese version is available.

term system roadmap until disaster risk management starts to function as a social system, and adopting a strategic support approach that takes the fullest advantage of Japan's knowledge/expertise to meet the needs of the beneficiary country, and designing (inputs, project period and phasing) the project for capacity building of disaster risk management in a manner that ensures the achievement of project outcomes." This project was not conceived to put these knowledge lessons into practice, but is a good example of incorporating these lessons during the project formulation stage.

With regard to the project design that ensures the outcomes, this project secured superior Japanese experts who had the capability to deal with Brazilian C/Ps' high technical expertise, and were active on the frontline in their respective fields in Japan. The availability of exceptional talents is often limited, but efforts were made to secure their participation in advance. Also, the project placed a tactful and resourceful professional, as its Coordinator who was skilled at managing various organizations both in Brazil and Japan and acted as a pivotal person in the project implementation. Considering the strategic approach to supporting Brazil's disaster risk management from the early stage of project design, and constructing the institutional arrangement that can implement the plan without fail led to the project's success. Related to taking the full advantage of Japan's knowledge/expertise to meet the needs of the beneficiary country, the impact went well beyond this project. When this project was being implemented, some technical needs of the Brazilian C/Ps came to light. To disseminate superior technologies of the Japanese private sector in the field of disaster risk reduction, a few private sector collaborating programs were developed. It can be said that Japan has contributed to the mainstreaming of disaster risk reduction in Brazil in line with the "Sendai Framework for Disaster Risk Reduction 2015-2030" adopted by the Third UN World Conference on Disaster Risk Reduction.

Related to the implementation arrangement and activity, there are some issues to be considered when formulating projects for Brazil. Brazil has abundant human resources, not only in the government, but also at universities, research organizations, and the private sector. While developing manuals and other products, C/Ps mobilized researcher groups and private sector consultants to assist manual development and review of their contents. Both Brazilian and Japanese personnel involved in this project later expressed that it would have been better to engage these researchers and private consultants from the start. Since government organizations and staffing are often influenced by political factors, involving actors that will not be affected by a change in administration will ensure the continuation of the project outputs and sustainability after the project. Selecting personnel to engage in the project from a broad perspective and provide for the participation of these researchers from the early stage of planning should be considered. Regarding the collaborative operation system among various federal and local organizations including the above-mentioned relevant parties, it would have been better to incorporate the project activity that all relevant parties discuss a mechanism that enables their continued

cooperation after the project completion and make efforts such as establishing the government as an official committee or working group by the end of the project.

End