

United Mexican States

FY2021 Ex-post Evaluation Report of Technical Cooperation Project

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

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0. Summary

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

1. Project Description



Project Location



Exterior view of CNRG

1.1 Background

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

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

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

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

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

1.2 Project Outline

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

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

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

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

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

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

1.3.3 Recommendations from the Terminal Evaluation

(1) Recommendations until the completion of the Project

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

(2) Recommendations for post-project period

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

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda (Global Group 21 Japan, Inc.)

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2021 - November 2022

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

2.3 Constraints during the Evaluation Study

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

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

3.1 Relevance/Coherence (Rating: ③⁵)

3.1.1 Relevance (③)

3.1.1.1 Consistency with Development Plan of Mexico

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

3.1.1.2 Consistency with Development Needs of Mexico

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

3.1.2 Coherence (③)

3.1.2.1 Consistency with Japan’s ODA Policy

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

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

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

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

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

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

3.1.2.2 Internal Coherence

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

3.1.2.3 External Coherence

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

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

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

3.2 Effectiveness and Impact⁶ (Rating: ③)

3.2.1 Effectiveness

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

3.2.1.1 Achievement of Outputs

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

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

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

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

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

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

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



DNA sequencers provided by the Project



Next-generation DNA sequencers purchased by CNRG

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

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

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

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

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



Orthodox seeds stored in cold dry storage



Potatoes stored in growth-suppressed conditions



Cryopreservation using aluminum cooling plates (left and middle)



Cryopreservation chamber (right)

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

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

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

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

3.2.1.2 Achievement of Project Purpose

Table 1: Achievement of Project Purpose

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

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

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

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

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

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

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

3.2.2 Impacts

3.2.2.1 Continuation of Activities after Completion of the Project

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

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

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

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

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

preservation of pine, mahogany, etc.

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

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

(2) Utilization of the genebank

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

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

Table 2: Genetic Resources Conserved in CNRG's Genebank

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

Source: Prepared from materials provided by CNRG

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

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

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



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

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

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

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

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

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

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

(4) Genebank-related networks

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

3.2.2.2 Achievement of Overall Goal

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

3.2.2.3 Other Positive and Negative Impacts

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

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

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

well-being.

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

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

3.3 Efficiency (Rating: ④)

3.3.1 Inputs

3.3.1.1 Inputs

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

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

Table 3: Planned and Actual Inputs

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

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

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

3.3.1.2 Project Cost

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

JICA budget execution procedures made it difficult to respond.

3.3.1.3 Project Period

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

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

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

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

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

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

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

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

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

it.¹⁷

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

3.4.2 Institutional/Organizational Aspect

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

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

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

3.4.3 Technical Aspect

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

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

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

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

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

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

3.4.4 Financial Aspect

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

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

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

Source: Prepared from materials provided by CNRG

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

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

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

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

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

3.4.5 Environmental and Social Aspect, Preventive Measures to Risks

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

3.4.6 Status of Operation and Maintenance

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

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

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

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

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

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

4.2.2 Recommendations to JICA

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

and monitor their implementation.

4.3 Lessons Learned

Diversified and continuous research cooperation utilizing various schemes

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

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective perspective (N/A)

5.1.2 Subjective perspective (retrospective) (N/A)

5.2 Additionality

None in particular.

END