Internal Ex-Post Evaluation for Technical Cooperation Project (SATREPS[1])

conducted by Colombia Office: December, 2025

Country Name	**Project for Development and Adoption of Latin American Low Input Rice Production System through Genetic Improvement and Advanced Field Management Technologies**
Republic of Colombia	

I. Project Outline

Background	In Colombia, rice cultivation occupies the third largest area after coffee and maize. Rice production has been exceeded 2.5 million tons since 2007, which was the fourth largest in the Americas after the United States of America (USA), Brazil and Peru. In the irrigation for rice cultivation area over field irrigation was the norm, and water use efficiency was low. While there was increasing demand for dry season rice cultivation, which had not been practiced in the past, the decline in rice production due to drought and other factors became an issue and the need for efficient use of limited water resources increased. In addition, the production costs of rice production were relatively high compared to neighboring countries, estimated to be about 20% higher than in USA and about 15% higher than in Peru due to improper water management, lack of fertilizer management technology, and other factors. It was expected that Colombian rice farmers would be severely affected if imports of cheap rice increased according to the schedule of the Free Trade Agreement (FTA) with USA. To address these issues, there was a need to conduct research that contributes to the development of resource-efficient rice cultivation technologies that increase the efficient use of water resources and fertilizer components to enhance the competitiveness of rice production.		
Objectives of the Project	Through developing new breeding lines with higher water and nitrogen use efficiencies, resource-efficient crop management strategies, and water-efficient production system, the project aims at developing resource-efficient rice production techniques, thereby contributing to dissemination of the developed techniques in Colombia and Latin American countries. 1. Expected Overall Goal: The resource-efficient rice production techniques developed in the project are disseminated to agricultural products in Colombia and Latin American countries. 2. Project Purpose: To develop resource-efficient rice production techniques and their implementation methods suitable for Colombian environment.		
Activities of the Project	1. Project Site: Departments of Valle del Cauca, Tolima 2. Main Activities: a) Developing new breeding lines with higher water and nitrogen efficiencies, b) Developing the resource-efficient crop management and fertilization strategies at farm scale, c) Establishing the water-efficient rice production system at watershed scale, and d) Integrating the trial results from the precision agriculture experiments and developing a practical system for technology transfer and capacity building. 3. Inputs (to carry out above activities) Japanese Side 1) Experts: 21 persons 2) Trainees Received: 40 persons 3) Equipment: rainout shelters, teleconference system, leaf area meter, photosynthesis measuring instrument, spectrophotometric analyser, milling equipment, threshing machine, electronic balance, boom irrigation system and soil sampling kit, etc., Colombia Side 1) Staff Allocated: 25 persons 2) Facilities and Equipment: Office spaces, experimental fields and facilities, (International Center for Tropical Agriculture) high-capacity centrifuge, crushing machine for genetic analysis, multispectral camera and multiband camera etc; (National Federation of Rice Growers) tripod lightning, rod support, polypipes, and solar panels, etc.; (Latin America Fund for Irrigated Rice) near infrared reflectance spectroscopy.		
Project Period	(ex-ante) March 2014 – Feb 2019 (60 months) (actual) 5 May 2014 – 4 May 2019 (60 months)	Project Cost (Japanese side only)	(ex-ante) 300 million yen, (actual) 387 million yen
Implementing Agency	Ministry of Agriculture and Rural Development (MADR), International Center for Tropical Agriculture (CIAT), National Federation of Rice Growers (FEDEARROZ), Latin American Fund for Irrigated Rice (FLAR) and University of Valle (UNIVALLE)		
Cooperation Agency in Japan	The University of Tokyo, The National Agriculture and Food Research Organization (former The National Institute of Agrobiological Sciences), Tokyo University of Agriculture and Technology, Kyushu University		

II. Result of the Evaluation

<Constraints on Evaluation>

The survey to collect data for one of two indicators to verify the achievement of the expected Overall Goal was not conducted by the implementing agencies mainly due to the COVID-19 pandemic, and since then, no related data has been collected.

1 Relevance/Coherence

[Relevance]

<Consistency with the Development Policy of Colombia at the Time of Ex-Ante Evaluation >

The project was consistent with the agricultural development policy of Colombia at the time of ex-ante evaluation. The "Colombian National Development Plan" (2010-2014), which called for a proactive approach to agriculture and land policy as a driving force for economic development, aimed at improving the standard of living of farmers. Also, the project idea which geared toward improving

[1] SATREPS: Science and Technology Research Partnership for Sustainable Development

agricultural productivity and environmental sustainability was consistent with the agricultural development policy at the time of ex-ante evaluation.

<Consistency with the Development Needs of Colombia at the Time of Ex-Ante Evaluation >

The project was consistent with the development needs of Colombia at the time of ex-ante evaluation. Developing a new resource-efficient crop production techniques, resource-efficient crop management strategies and water-efficient production system has addressed the challenge of inadequate water management and lack of fertilizer management technology.

<Appropriateness of Project Design/Approach>

The project design/approach was appropriate. The project was carried out in regions where rice cultivation is intensively practiced, and actively involved farmers in project activities, not only as beneficiaries but also as members of research activities, which allowed technology transfer and adoption by vulnerable farmers. From the lessons learned from past similar project, the rice seed varieties that were easily accepted were selected and methods for proposing fertilizer and water management consideration that were easy for farmers were adopted with the support and cooperation of institutions like CIAT, FEDEARROZ, FLAR and Colombian government. No problem attributed to the project design/approach was confirmed.

<Evaluation Result>

In light of the above, the relevance of the project is ③[2].

[Coherence]

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with the Japan's ODA policy to Colombia at the time of ex-ante evaluation. In Japan's "Country Assistance Policy for Colombia" (March 2013), "balanced economic growth" was listed as a priority development issues. The SATREPS project which contributes to the revitalization of small-scale farmers and local economies through the development of resource efficient rice cultivation technologies was in line with the priority issue in the aforementioned assistance policy.

<Collaboration/Coordination with JICA's Other Interventions>

The collaboration/coordination between the project and JICA's other intervention was not planned at the time of ex-ante evaluation, but was implemented during project implementation, and the positive effects were confirmed. Some researchers and farmers participated in the SATREPS project participated in the Knowledge Co-Creation Program (KCCP) courses or specialized training programs in Japan. Some of the training courses included the technologies and methodologies directly related to the SATREPS project, such as mapping, the development of sensors in the crops, the improvement of genetic characterization through images and of the root architecture, the water resource management with irrigation monitoring system like Multiple Inlet Rice Irrigation (MIRI) and the integration of maps and satellite images for soil preparation and adaptation. Thus, the participation of researchers had positive impact on the achievement of project objective, mainly through raising awareness and importance of these technologies in the agricultural process as an essential fact for the efficiency in the use of natural resources. Also, the participation of farmers in the training program enhanced the awareness of the importance of the environment and compliance with regulations, etc., as well as the importance of cooperation among related parties.

<Cooperation with other institutions/ Coordination with International Framework>

The cooperation/coordination with other donors or international framework was not planned at the time of ex-ante evaluation, but was implemented during project implementation, and the positive effects expected were confirmed at the time of ex-post evaluation. The e-kakashi technology led by SoftBank Corp. was tested in the rice field in the framework of the SATREPS project[3]. In the framework of the project, the e-kakashi technology reduced water and fertilizer use during the project, and the researchers in the SATREPS project understood the importance of incorporating IoT technologies (a system that enables remote operation and automatic control by embedding sensors and communication functions in devices and equipment, connecting them to the Internet, and enables collect and share data) in the project to measure different variables and the impact it had on the crop productivity. As a result of the SATREPS project, follow-up initiatives have successfully extended the use of decision support system of e-kakashi technology to new geographies such Ecuador and Brazil. The e-kakashi technology introduced through the SATREPS project have been adopted to greenhouse agriculture in Mongolia and Uzbekistan.

In Colombia, after the SATREPS project, CIAT developed a new project with the e-kakashi technology in order to continue with the resource efficient crop production techniques and dissemination of the technologies at a local level.

<Evaluation Result>

In light of the above, the coherence of the project is ②.

[Evaluation Result of Relevance/Coherence]

In the light above, the relevance/coherence of the project is ③.

2 Effectiveness/Impact

[2] ④ : very high, ③ : high, ② : moderately low, ① : low

[3] The e-kakashi technology supports the cultivation process of farmers and the increase of rice production by combining the Internet of Things (IoT), big data, artificial intelligence and cyber-physical systems to collect environmental and meteorological data, agricultural work experience, practices and agricultural knowledge. SoftBank Corp. and IDB Lab (Inter-American Development Bank (IDB)'s innovation lab) considered that the Latin American region has the potential to become a worldwide producer of food and agricultural products and considered important to implement actions to improve and maximize its potential. From 2017, the pilot of the e-kakashi technology was started in Colombia by CIAT in the pilot rice fields in Cali, Valle del Cauca within the SATREPS Rice project. The experience using this technology allowed the development of IDB Lab project beginning with small-scale rice farmers (5.9 hectares) in Cauca and Valle del Cauca and sought to expand its coverage to other departments like Arauca and Casanare. This e-kakashi technology contributes to reduce environmental problems such as water supply and greenhouse gas emissions, and calculates the optimal water use levels from rice crops at each plant growth level to reduce methane emissions. The expected results of the technology are: (i) create digital manuals on cultivation know how by using the collection and analysis of environmental data to increase productivity, and (ii)conserve water and reduce methane emissions. The e-kakashi technology was transferred to Green Corporation, a company launched by the developers of the e-kakashi technology at SoftBank Corp. on July 1, 2024.

<Status of Achievement of the Project Purpose at the Time of Project Completion>

At the time of project completion, the Project Purpose was achieved as planned. The SATREPS project developed 14 production technologies for resource-efficient rice production that adapt to Colombian rice production and applicable and/or usable for farmers. The Technical Guide in English and Spanish version, which briefly summarizes the 14 production technologies develop in the SATREPS project, was prepared, printed, and distributed to interested parties as a tool for information sharing and famer active participation that enable farmers to easily accept and adopt technology transfer, creation of new breeding lines, and fertilizer and water management methods. The main dissemination strategy of the project was developed and implemented through AMTEC program (Massive Adaption of Technology), whose was launched in 2018 by FEDEARROZ to make farmers competitive through the adoption and technology transfer in order to increase productivity and reduce production cost.

<Continuation Status of Project Effects at the Time of Ex-Post Evaluation>

By the time of the ex-post evaluation, the project effects have been continued and further developed. The outputs produced by the SATREPS project have been used since the project completion mainly by CIAT and FLAR in the development projects related with breeding lines and improving the rice program with projects such as new breeding lines, germplasm, and regenerative farming. The outputs produced by the SATREPS project are not only utilized to continue improving rice production, but also to make some trials to estimate methane emissions from rice paddy fields and mitigate the impact on climate change and create projects of security and food programs. Research related to the research outputs produced by the SATREPS project has been conducted by CIAT and FLAR. CIAT constructed a rice program at the Alliance of Biodiversity that contributes to food and nutrition security by producing and improving rice production as a primary energy source. CIAT has conducted research for new breeding line development and improvement of agronomic practices. As for the status of utilization of facilities and equipment provided by this project, most of them have been utilized frequently for rice production related research especially by CIAT. The lesser used equipment is leaf area meter and spectrophotometric analyzer since the leaf area meter does not work for the area where CIAT has new projects, and the spectrophotometric analyzer is an equipment for laboratory and CIAT's current research is focused on field and crop analysis. The dissemination of new varieties, agro-meteorological services, cultivation technology decisions, soil mapping technology, irrigation water measurement technology, etc. was decided to include in the technical workshop for AMTEC program. In addition, the counterparts of the project such as FEDEARROZ and MADR ensure that technologies developed in the project are accessible and usable by farmers (Indicator 1).

<Status of Achievement for the Expected Overall Goal at the Time of Ex-Post Evaluation>

At the time of ex-post evaluation, the Intended Overall Goal has been partially achieved. The survey to collect data on the adaptation of resource-efficient rice production techniques developed in the SATREPS project by rice producers in Tolima Department (Indicator 1) was not conducted by the implementing agencies mainly due to COVID-19 pandemic, and since then, the survey has not been conducted. On the other hand, the dissemination activities have been conducted in three countries of Latin America, which are Colombia, Brazil and Ecuador as well as Uzbekistan and Mongolia by different dissemination programs led by FEDEARROZ, CIAT and FLAR, and also IDB-Lab and e-kakashi projects (Indicator 2).

<Other Impacts at the Time of Ex-Post Evaluation>

The SATREPS project has a positive impact on the environment since the technologies developed in the project have been used to increase rice crop production and improve resource-efficient management including efficient use of water and nitrogen and reduction of the number of fertilizers used. As for social aspects, the project had a positive impact on local communities in terms of empowerment. The SATREPS project including the dissemination programs increases the access to information and technology that empowers rice communities and increases researchers' abilities, techniques and knowledge to improve their rice production. In addition, some farmers participated in the SATREPS project as researchers. This allowed the project to have both perspectives from scientists and farmers as a way to improve rice production levels with the experiences and knowledge of both parts.

The project has a positive impact on the capacity development of researchers and farmers who participated in the SATREPS project, especially young researchers in FEDEARROZ and CIAT. The main area of capacity developed are: (i) new rice breeding lines for new rice varieties; (ii) Agronomical practice for better input use efficiency; (iii) smart agriculture using IoT and AI (Artificial Intelligence), capacity building in terms of drones and sensors, technology transfer and analysis methods. Also, researchers had opportunities to increase and evaluate their technological skills applied to the agricultural sector. The field training in Japan also contributes to increasing their knowledge, skills and abilities in terms of technology transfer, AI use, and analysis methods. A researcher who participated in this project had an opportunity to get officially enrolled in a doctoral program at the University of Tokyo. During the project period, with the test of the e-kakashi led by Softbank, the researchers of the SATREPS project understood the importance to incorporate IoT technologies in the project to measure different variables and the impact it had at the crop productivities. No negative impacts on natural environment and social aspects were identified.

<Evaluation Result>

In light of the above, the effectiveness/impact of the project is ③.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results	Source
(Project Purpose) To develop resource-efficient rice production techniques and their implementation methods suitable for Colombian environment.	Indicator 1 Resource-efficient rice production technologies and their implementation methods suitable for Colombian environment are developed.	Status of the Achievement (Status of the Continuation): achieved as planned (continued and further developed) (Project Completion) • 14 production technologies for resource-efficient rice production were developed in the SATREPS project. • The English and Spanish version of the Technical Guide, which briefly summarizes the technologies developed in the SATREPS project were prepared, printed and distributed	Terminal Evaluation FEDEARROZ - SATREPS Project Monitoring Report Fedearroz (2019- 2020) - Monitoring Report Fedearroz 2019-2020 - others Inter-American Development Bank IDB website

		to interest parties. • As part of AMTEC 2.0, FEDEARROZ launched the dissemination program. (Ex-Post Evaluation) • The project developed 14 production technologies that adopt to Colombian rice production environment and are applicable or usable for farmers. Counterpart institutions like FEDEARROZ and MADR ensured that technologies developed in the SATREPS project are accessible and usable by farmers.	- IDB-Lab project: e-kakashi: The Agriculture AI Brain (2019-2022) JICA website JICA SME supporting survey
(Expected Overall Goal) The resource-efficient rice production techniques developed in the project are disseminated to agricultural production in Colombia and Latin American countries.	Indicator 1 The resource-efficient rice production techniques developed in the project adopted to 30 % of rice producers in Tolima Department	Status of the Achievement: Not Verifiable (Ex-Post Evaluation) The survey to collect necessary data for the indicator 1 in Tolima Department was not able to be conducted during the COVID-19 pandemic period (2020 & 2021) by CIAT and FEDEARROZ and even after the pandemic, the survey has not been conducted.	FEDEARROZ website IDB website - IDB-Lab project: e-kakashi: The Agriculture AI Brain (2019-2022) JICA website -MIC Projects led by SoftBank "Demonstrative Research on Agricultural IoT Platforms Toward Promoting Data Driven Agriculture" Colombia (2018-2020), Ecuador (2019-2022), Brazil (2021-2023), Mongolia, and Uzbekistan (2022-2023): -JICA SME supporting survey
	Indicator 2 The dissemination activities are conducted at least in two Latin American countries.	Status of the Achievement: achieved as planned (Ex-Post Evaluation) The dissemination activities are conducted in three countries of Latin America, which are Colombia, Brazil and Ecuador. Also, the dissemination activities have been conducted in Uzbekistan and Mongolia. There are different dissemination programs led by FEDEARROZ, CIAT and FLAR, and also IDB-Lab and MIC e-kakashi projects.	

3 Efficiency

The project period was as planned (the ratio against the plan: 100%) and the project cost exceeded the planned cost (the ratio against the plan: 129%). Due to the combined factors, the project cost exceeded the planned cost.

	Project Cost (Japanese side only, yen)	Project Period (months)
Plan (ex-ante)	300 million yen	60 months
Actual	387 million yen	60 months
Ratio (%)	129%	100%

Outputs were produced as planned. In the light above, the efficiency of the project is ③.

4 Sustainability

<Policy Aspect>

In the latest NDP (2022-2026), there is a policy related to productive economy through industrialization and bioeconomy, aiming at creating bioeconomy model based on knowledge, innovative, and research for highly value-added production in the sector such agriculture, cattle, forestry and fishing. Also, there is the Rice Production Management Plan (2020 – 2038), that seeks to improve rice productivity, strengthening research, development, and innovation, increase the use of certified seeds, optimize the use of water resources, and consolidating environmental sustainability. The structural axes of the plan are production and market efficiency, goods and services for regional specialization, and institutions, community and environment. Although there is no government policy that was created from the SATREPS project, the results of the project and strategies such as AMTEC from FEDEARROZ contribute to the objectives of the policy that seeks to mitigate GHG emissions and thus climate change.

<Institutional/Organizational Aspect>

There is an institutional agreement to use the research results of the SATREPS project. This agreement involves several organizations, including CIAT, FEDEARROZ, FLAR, the Universidad Nacional Del Valle and MADR. Research related to the research outputs produced by the SATREPS project has been conducted by CIAT and FLAR. CIAT constructed a rice program at the Alliance of Biodiversity that contributes to food and nutrition security by producing and improving rice production as a primary energy source. CIAT has conducted research for new breeding line development and improvement of agronomic practices. In addition, under the Memorandum of Understanding (MOU) between CIAT and partner institutions including Instituto Nacional de Investigaciones Agropecuaria (INIAP, National Institution of Agriculture and Livestock Research) in Ecuador and Federal University of Santa Maria and Crops Team in Brazil, the result of the SATREPS project is continued to be disseminated in these countries through MIC e-kakashi project led by SoftBank. In Colombia, the output of the SATREPS project is used by some universities for research purpose and used for seed production and commercialization by FEDEARROZ. Thus, it can be said that there is a prospect that the continuation of related researches and

dissemination activities in other Latin American countries have been continued. Nevertheless, the lack or absence of collaboration with institutions like MADR after the project completion hinders the arrangement between governments in the Latin American region. Equipment installed by SATREPS project was donated to CIAT and FLAR and the detailed list of the status of this equipment is maintained and mostly in use. In addition, high turnover rates at the implementing entities may affect sustainability of the project effects in the future in terms of the continuation of future actions, dissemination strategies, and other activities after project completion, information sharing and communication with implementing agencies.

<Technical Aspect>

Researchers involved in the SATREPS project improved their research capacity to develop new projects based on the results of the SATREPS project. In addition, the researchers' capacity has been and will be sustained and improved through workshops and training supported by institutions like FDEARROZ and new collaboration projects including CIAT rice program, Inter-American Development Bank Lab, e-kakashi projects and JICA's SDGs Business Model Formulation Survey with the Private Sector "Transferring Rice Transplant Technology and Developing Value-added Supply Chain in Colombia." Thus, researchers are likely to maintain or improve their research capacity in the future through these ongoing projects, continuous training, and application of acquired knowledge, which are also key factors to attract and retain skilled personnel.

<Financial Aspect>

FEDEARROZ and CIAT have continuously obtained financial resources, including an external research fund to continue their activities using the research results of the SATREPS project and to begin new projects. Examples of funding include CIAT rice program, IDB Lab, and e-kakashi projects. These programs have provided financial resources with the improvement of productivity and sustainability of rice farming in Colombia. In addition, CIAT is financed by contributions from member countries and FEDEARROZ is financed by private companies and partners of the federation. These are sustainable resources and there are no big concerns for future funds. Further, FEDEARROZ receives the government funding to continue the dissemination strategy and technology transfer for rice producers in Colombia. However, as described in the section of "impact", the data related to the technology dissemination was not collected. This implies that there are some risks that the institutions can continue the dissemination activities sufficiently with the financing resources from the government funding and international donor funding. Therefore, even though there are some donor funding projects which enable to continue with rice production research at current, developing a financial strategy seeking for alternative sources of funding that can reduce the dependency on donor funding is essential for the project's sustainability, which includes establishing strategic partnership with private companies and generating income through technology and knowledge transfer.

<Environmental and Social Aspect>

No issue on environmental and social aspects has been observed, and it has not been necessary to take any countermeasures.

<Evaluation Result>

In light of the above, slight problems have been observed in terms of the policy/institutional/organizational and financial aspects. Therefore, the sustainability of the project effects is ③.

5 Summary of the Evaluation

The project mostly achieved as Project Purpose for developing resource-efficient rice production techniques and their implementation methods suitable for Colombian environment as planned, and partially achieved the Expected Overall Goal for disseminating the resource-efficient rice production techniques developed in the SATREPS project to agricultural products in Colombia and Latin American countries. There is an institutional agreement to use the research results of the SATREPS project. This agreement involves several organizations, including CIAT, FEDEARROZ, FLAR, the Universidad Nacional Del Valle and MADR. Research related to the research output by the SATREPS project has been conducted by CIAT and FLAR.

Considering all of the above points, the SATREPS project is evaluated to be highly satisfactory.

III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

- As described in the section of "impact", the data related to the technology dissemination was not collected. This implies that there are some risks that the institutions can continue the dissemination activities sufficiently with the financing resources from the government funding. Therefore, even though there are some donor funding projects which enable to continue with rice production research at current, in order to reduce financial dependence on donors' resource, it is important to create financial strategies seeking for alternative sources of funding that can reduce the dependency on donor funding within institutions for them to obtain their own resources and ensure project continuation, which includes establishing strategic partnership with private companies and generating income through technology and knowledge transfer.
- As described in the sustainable section, high turnover rates in Colombia's institutions may affect the continuity of project effects and their sustainability in the future, It is necessary that constant communication, ensuring follow-up reports, and encouraging institutions to share project information internally with new officials would allow them to generate strategies for ensuring continuity and reporting once the JICA project ends.

Lessons Learned for JICA:

- One indicator for Overall Goal was not collected by the implementing agencies. While the COVID-19 pandemic might affect the conducting the survey to collect necessary data and dissemination activities, by the implementing agencies, the JICA's communication with the implementing agencies was not constant and the project's follow-up report was not received since 2020. Also, the high-turnover rate in Colombia's institutions might prevent from communicating adequately with JICA. Therefore, in order to monitor the project and keep communication with counterparts after the project completion, it is desirable that at the final stage of the project, JICA agree with all counterparts to continue to submit follow-up reports and monitor indicators after project completion with ensuring constant communication with officials in counterparts.

Direct seeding of rainfed rice with machine of the SATREPS project

Confined biosafety field (GM field) in the CIAT Palmira campus[4]

[4] The image illustrates three treatments applied to rice cultivation: (i) Control: Standard conditions where machinery is used in rice crops, (ii) Lowland: covering the crop to reduce water evaporation and provide shade, and (iii) Upland: Test the crop's performance in dry climates with minimal rainfall to assess its resistance in low water levels.