Republic of Nicaragua

FY 2015 Ex-Post Evaluation of Technical Cooperation Project
"Project on Diffusion of the Sustainable Agricultural Technology for Small Farmers"

External Evaluator: Hajime Sonoda, Global Group 21 Japan, Inc.

0. Summary

The "Project on Diffusion of the Sustainable Agricultural Technology for Small Farmers" (hereinafter referred to as "the Project") was implemented to strengthen the diffusion system on sustainable agriculture of the Nicaraguan Institute of Agriculture and Livestock Technology (*Instituto Nicaragüense de Tecnología Agropecuaria*, hereinafter referred to as "INTA") and initiate the application of learned techniques by small-scale farmers in the Central North, Pacific South and Managua zones of Nicaragua[1], with the overall goal of diffusing sustainable agriculture among small-scale farmers in these areas. At the time of both planning and project completion, the introduction of techniques for sustainable agriculture was found to be highly consistent with the Government of Nicaragua's development policies and of high necessity. Moreover, since it was consistent with Japan's aid policies, the Project is highly relevant. The project purpose was largely achieved, and it is surmised that the overall goal was also attained. Furthermore, following completion of the Project, INTA had started widely promoting the techniques for sustainable agriculture and there has been an extensive impact; therefore, the effectiveness and impact of the Project are high. The Project period was within schedule; the activities on the whole proceeded smoothly; and the technical transfer by the Japanese experts was conducted effectively. However, because the project cost exceeded the planned amount, efficiency of the Project is fair. Sustainability of the Project in terms of policy, organization and technology is high. In financial terms, INTA has a high degree of dependence on donors. However, it is expected that activities in the demonstration farms that utilize the results of the Project will be continued even when the donor assistance comes to an end. Accordingly, sustainability of the Project is high.

In light of the above, the Project is evaluated to be highly satisfactory.

[1] Target area of this project is the Central North Zone (those provinces of Matagalpa and Jinotega), the Pacific South Zone (those provinces of Masaya, Granada, Caraso, Rivas) and Managua Zone (Managua province).

1. Project Description

Project Location

Nursery tunnel for vegetable (pest management)

1.1 Background

The Republic of Nicaragua (hereinafter referred to as "Nicaragua") has a population of 5,670,000 people (2008), and it is one of the lowest income countries in Latin America due to the economic damage caused by the civil war that lasted for more than 10 years from 1979. The poverty reduction strategy that was compiled in 2005 intended to reduce the ratio of the population living in extreme poverty (annual income no higher than USD 200) from 15.1% to 11.5% by 2010. However, in order to achieve this goal, it was essential to address poverty via the vitalization of agricultural sector, which employs some 30% of the working population (as of 2008).

Almost all agricultural producers in Nicaragua are small and medium-scale farmers[2]. Problems facing the agricultural production were low productivity and profitability due to lack of technology including measures for soil fertilization management and pest control, lack of information on markets, lack of producers' organization for purchasing materials and selling products and so on. Furthermore, use of inappropriate pesticides had led to health problems and environmental contamination; while the growth of large plantations that conduct excessive pasturing and use large quantities of chemical fertilizers had caused the deterioration of soil fertility.

In response to such conditions, the Government of Nicaragua, while making efforts to increase agriculture products, through proposing "National Strategy for Promotion of Organic Farming in Nicaragua" in 2005 and other means, tried to promote "sustainable agriculture" as low-cost and competitive alternative agricultural technology that is suitable to the local situations[3]. Sustainable

---

[2] Nicaragua has approximately 2.6 million farmers (producers), of which 94% are small and medium-scale farmers. Definitions of the scale of farmers differ between areas based on the type of crops and area of farmland.

[3] In Nicaragua, from the 1980s, international NGOs promoting fair trade started disseminating organic cultivation of coffee and cacao while private sector organizations introduced a certification system for organic farming. In addition, due to the influence of European and American NGOs and donors, groups such as National Union for Agriculture and Livestock started to disseminate sustainable agriculture from the 1990s. Entering the 2000s, against a backdrop of growing interest in and demand for organic farming and sustainable agriculture, the government compiled "National Strategy for Promotion of Organic Farming in Nicaragua" upon widely gathering information and exchanging opinions with farm producers, consumers, certification agencies, and groups promoting organic farming and sustainable agriculture all over the country.

agriculture is defined as “a farming system that restricts use of chemical fertilizers, agricultural chemicals, etc., and thereby contributes to the realization of safer food production and conservation of natural resources and environment, while aiming for higher productivity and incomes.” In order to resolve the problems facing small-scale farmers while observing this strategy, it is necessary to offer concrete options of techniques for sustainable agriculture to farmers. In Nicaragua, INTA used to be in charge of developing and diffusing agricultural techniques among small- and medium-scale farmers, however, it lacked experience in sustainable agriculture. It was against such a background that the Government of Nicaragua requested JICA to provide assistance for development and diffusion of techniques for sustainable agriculture to small-scale farmers, and the technical cooperation project for this was implemented from March, 2008[4].

1.2 Project Outline

The Project was implemented to strengthen the diffusion system on sustainable agriculture of INTA and initiate the application of learned techniques by small-scale farmers in the target areas, with the overall goal of diffusing sustainable agriculture among small-scale farmers in the Central North, Pacific South and Managua zones of Nicaragua.

Overall Goal		Techniques for sustainable agriculture are diffused among small-scale farmers in the target areas.
Project Purpose		The diffusion system of sustainable agriculture of INTA is strengthened, and small-scale farmers in the target area initiate using the learned techniques.
Outputs	Output 1	Techniques on sustainable agriculture are developed.
	Output 2	Methodology for technical certification for diffusion of techniques on sustainable agriculture is established.
	Output 3	Farmers in the target areas learn the techniques of sustainable agriculture.
Total Cost (Japanese Side)		382 million yen
Period of Cooperation		March, 2008 - March, 2013
Implementing agency		Nicaraguan Institute of Agriculture and Livestock Technology (INTA)
Other Relevant Agencies / Organizations		None
Supporting Agency / Organization in Japan		None
Related projects		“Project for Improvement of Living Standard through Promotion of the Farming Production in the Indigenous / Ethnic-Communities of Puerto Cabezas” (February, 2008-February, 2013), “Project on Community Level

[4] The Project targets being small farmers, however, because INTA makes no distinction between small-scale farmers and medium-scale farmers in its activities, the Project also included both small and medium-scale farmers among its targets. For simplicity, all target farmers are referred to as small-scale farmers in this report.

	Alliance for Strategical Implementation of Rural Development" (March, 2009-March, 2013), "Vocational Training Improvement Project in Agricultural and Livestock Sector" (September, 2013-September, 2018)

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of the Project Purpose at the Time of the Terminal Evaluation

Through the training and extension activities at the Demonstration and Training Plot (*Parcela Demostrativa y de Capacitación*; hereinafter referred to as "PDC"), the capacity building of INTA technicians (extension officers) has been realized[5]; it appears that the system for certification of technicians will be proposed, and the situation regarding application of techniques by the farmers targeted for diffusion of techniques for sustainable agriculture is good. Accordingly, it is judged that the degree of achievement of the Project purpose has been high.

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

Since it is scheduled for activities to be continued in the target areas following completion of the Project, it is judged that there is a good possibility that the indicator stating that "more than 840 small-scale farmers (40% of small-scale farmers) in the target areas practice the techniques for sustainable agriculture by 2016" will be achieved.

1.3.3 Recommendations at the Time of the Terminal Evaluation

Short-term recommendations targeting the end of the Project are as follows:

- Filing of activity reports on field tests and conversion of electronic data to CDs
- Preparation of a proposal concerning revision of the system for technical certification of technicians and utilization of the system
- Completion of the technical certification of technicians in the target areas
- Completion of technical pamphlets and manuals for technicians and farmers
- Improvement of the contents of the draft training curriculum for technicians and consolidation of training materials
- Preparation of the final version of the guidebook on PDC activities for pilot farmers
- Implementation of a project completion seminar

Long-term recommendations targeting after the completion of the Project are as follows:

- Continued implementation of validation tests in Technical Development Centers and PDCs
- Continuous improvement of the diffusion techniques and diffusion system

[5] INTA had "extension officers" up to the end of the Project. However, as a result of organizational reform, the description of these officers was changed to "technical innovation and transfer technicians" (*Técnico de Inovación y Transferencia Tecnológica*). (Refer section 3.2.2.2. (1) for details) In this report, the term "technicians" that is currently in common use is used.

- Preparation of additional pamphlets on techniques for sustainable agriculture
- Continuous revision of the training curriculum and training materials for technicians with the addition of technical improvements
- Formulate a strategy concerning adaptation and diffusion of techniques for sustainable agriculture as a package, and technical training for technicians outside of the Project target areas and extension officers of other organizations

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda, Global Group 21 Japan, Inc.

2.2 Duration of Evaluation Study

The ex-post evaluation study for the Project was conducted over the following period.

Duration of the Study: October 2015 – Februrary 2017

Duration of the Field Survey: 26 February – 18 March, 2016

28 May – 2 June, 2016

2.3 Constraints during Evaluation Study

Concerning the composition and trends of budget, etc. in the implementing agency, it was not possible to acquire adequate information due to confidentiality. As a result, it was difficult to conduct the financial analysis in detail. Accordingly, sustainability was analyzed upon considering the contents and scale of the necessary costs and the types of INTA funding and so on for securing sustainability.

Moreover, because the field survey and beneficiary survey were conducted during the agricultural off-season, it was not possible to confirm the application of techniques on the land, making it difficult to acquire sufficiently accurate information concerning the application of techniques. Therefore, in cases where it was not possible to confirm the application of techniques in the field through the beneficiary survey, farmers were requested to explain the contents and applied conditions of techniques, and it was deemed that the techniques had been applied only in cases where specific and detailed explanations could be given.

3. Results of the Evaluation (Overall Rating: A[6])

3.1 Relevance (Rating: ③[7])

3.1.1 Relevance to the Development Plan of Nicaragua

As was described in section 1.1 Background, at the time of the ex-ante evaluation (2008), the Government of Nicaragua had proposed the National Strategy for Promotion of Organic Farming in Nicaragua (2005) and was promoting sustainable agriculture. Moreover, under the Ortega administration that commenced in 2007, as the national development plan of the highest level, the National Human Development Plan (2008-2012) made the promotion of agriculture sector, which provides employment for many impoverished people, one of the pillars of poverty reduction policy. The government displayed its intention to take various measures for enhancing food security on the domestic front, while supporting food self-sufficiency, making small-scale loans, diffusing improved seeds and so on with a view to promoting agricultural exports on the external front, as well as taking steps to establish a sustainable production setup in rural areas.

In 2009, the Ortega administration compiled the Program for Comprehensive and Sustainable Productivity and Rural Development (2010-2014) with the stated purpose of "contributing to fair human development while utilizing Nicaragua's natural resources on a sustainable basis." It then enacted the Law for Promotion of Agro-Ecological and Organic Production in 2011, proposing the framework of an official certification system geared to establishment of an organic agricultural market inside and outside of the country. Furthermore, in the new National Human Development Plan (2012-2016) that was announced in 2012, the policy of giving consideration to the conservation of natural resources was further clarified from the viewpoint of securing the sustainability of agriculture within initiatives aimed at expanding, diversifying and adding value to agricultural production[8]. As a result of such policies and initiatives, in 2014 INTA turned the focus of agricultural technologies for development and diffusion from agriculture that relies on large quantities of chemical fertilizers, pesticides and herbicides to sustainable agriculture. Moreover, the above plans also include responses to food security and climate change, and such themes are viewed with importance in the agricultural sector too.

As such, the Project is highly relevant to the development plans of Nicaragua at the time of planning and also at the time of its completion in 2013.

3.1.2 Relevance to the Development Needs of Nicaragua

As already mentioned in 1.1 Background, at the time of planning, agricultural producers in Nicaragua were faced with problems such as lack of techniques, market information and

---

6 A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

7 ③: High; ②: Fair; ①: Low

8 In this plan, "conservation of Mother Earth" is identified as an important policy issue and the following measures are emphasized: improvement of productivity, strengthening of responses to climate change and natural disasters, diversification of farm crops, utilization of local varieties, conservation of soil and water and so on.

organization. Also it was pointed out that use of improper agricultural chemicals is causing damage to human health and environment as well as depleting the fertility of farmland.

According to INTA, low productivity, soil degradation, lack of access to high-quality seeds and so on are still the problems that faced small-scale farmers at the time of ex-post evaluation, and INTA is tackling these issues mainly via techniques for sustainable agriculture. Additionally, there is a growing awareness that steps need to be taken to address issues of climate change such as the decline in rainfall brought about by the El Niño phenomenon, and INTA is responding to this through utilizing and furthering techniques for sustainable agriculture.

Based on the above, it is clear that the necessity for the Project is strong at the time of both the planning and Project completion.

3.1.3 Relevance to Japan's ODA Policy

Japan's Country Assistance Program for Nicaragua (2002) identified agriculture and rural development as one of the priority fields. JICA Country Program for Nicaragua (2007) also identified agriculture and rural development as one of the fields where technical transfer can be expected to have an impact. This Project was included in the program of assistance for sustainable productive technology in the agriculture and rural development field under the said program, and was regarded as making a contribution towards the issue of enhancing agricultural and livestock productivity. As such, the Project is consistent with Japan's ODA policies.

Based on the above, the Project is highly relevant to Nicaragua's development plans and development needs, as well as Japan's ODA policies. Therefore, its relevance is high.

3.2 Effectiveness and Impact[9] (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Revision of the Project Design Matrix

In the Project, the Project Design Matrix was revised at the time of the intermediate review survey (October, 2010). The target crops at the beginning of the Project were fruits and vegetables, however, in line with the Government of Nicaragua's decision to adopt a policy of placing emphasis on food security, staple crops such as rice, sweet corn, beans and so on were added to the targets while fruits were removed. Although this change was made in reflection of a policy shift and was an appropriate decision at the time, the switching of target crops midway through the Project impacted the efficiency of the activities. Furthermore, since many of the techniques for sustainable agriculture that were developed and diffused in the Project were applicable to crops that are labor intensive and were not entirely applicable to staple crops that entail large cultivated areas, they ended up being primarily applied to vegetables.

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

Output 2 was originally defined as “training system for diffusion of the developed techniques for sustainable agriculture is established,” however, “training system” was amended to “methodology for certification of technicians.” It was originally intended to embody contents for establishing a training system, however, technical certification was entirely the duty of the National Technological Institute and thus was not included in the work scope of INTA. Accordingly, the established technical certification methodology was only used for evaluating the capacity of INTA technicians during the Project, and it was not used any more following completion of the Project. As a result, it cannot be said that this modification was made based on sufficient examinations.

Apart from the above revisions, modifications were also made to clarify and enhance each indicator, which were largely appropriate.

3.2.1.2 Project Outputs and Process

（1） Development of techniques for sustainable agriculture (Output 1)

Following investigation of the farming conditions of small-scale farmers in the target areas and pre-existing techniques for sustainable agriculture, various tests were conducted with a view to developing techniques at three Centers of Technological Development in the target areas. INTA has approximately 90 researchers (as of 2009) engaged in the development of techniques around the country. Concerning the procedure for developing techniques, effectiveness is ascertained first through technical evaluation tests, and then the techniques are adapted via technical validation tests. The techniques that are certified to be practically applicable through both tests are listed in the Technology Catalog and are targeted for diffusion.

In the Project, 29 technical evaluation tests and eight technical validation tests were implemented on fruits, vegetables and staple crops. As a result, as techniques for improving soil fertility, “liquid fertilizer with fortified micronutrients” and “seedling raising soil utilizing crop residues” were newly added to the Techniques Catalog, while as techniques for controlling pests, “appropriate height of ridges in vegetable cultivation” and “utilization of sulfur and lime mixed material in bean cultivation” were added. Moreover, concerning more than 20 existing techniques that were already listed in the catalog, improvements were made via the Project, for example, locally available materials were used as alternative materials and so forth. In light of these facts, the Project output of developing techniques for sustainable agriculture was achieved[10].

[10] According to the indicators defined in the Project Design Matrix, the goal was to develop two techniques for improving soil fertility and two techniques for controlling pests, and both these goals were attained.

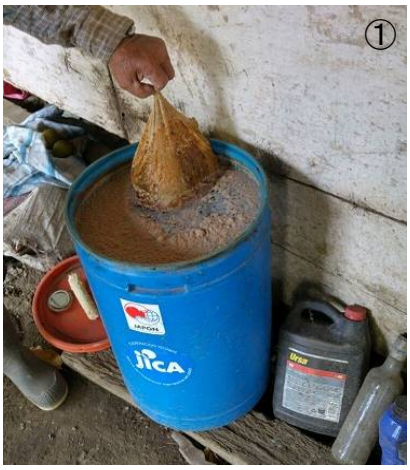
Box: Techniques (examples) for sustainable agriculture introduced in the Project

Technique for improving soil fertility; fertilizer

① Liquid fertilizer: Molasses, dead leaves with indigenous bacteria, cereal flour such as rice bran, grain flour, etc. are fermented. Sometimes, minute quantities of mineral components and bacteria are also added.

② *Bokashi*: This is made by piling and fermenting withered leaves, leaf charcoal (carbonized chaff), cow dung, grain flour, soil, molasses, etc.

③ Worm manure



Techniques for controlling pests

④ Sulfur and lime mixed material: Diluted and sprayed to prevent pests.

⑤ Insect trap: Insects are gathered and captured by luring with colors and odors.

⑥ Hedge fence: Infiltration by pests is prevented by means of a hedgerow.

Source: Compiled by the evaluator based on materials provided by JICA and INTA

（２） Capacity strengthening of technicians (extension officers) (Output 2)

INTA had approximately 200 technicians all over the country (as of 2009), and they were diffusing techniques mainly through making door-to-door visits to small-scale farmers. Also, they conducted field demonstrations in demonstration farms that were established in cooperating farmers. However, before the Project, because INTA was mainly concerned with diffusion of techniques for agriculture that utilized chemical fertilizers and agricultural chemicals, its technicians possessed hardly any knowledge on techniques for sustainable agriculture and even did not understand its necessity.

In the Project, Japanese experts conducted comprehensive training on techniques for sustainable agriculture for the INTA technicians and researchers. Over five years, a total of 1,345 persons received training that was conducted a combined 33 times over 53 days. Moreover, in third country training lasting approximately one week that was conducted four times in Costa Rica and the Republic of Dominica, a total of 60 trainees learned about the techniques being practiced in these two countries. In addition, 12 trainees were invited to Japan to take part in training on extension and organic farming techniques, vegetable cultivation and so on. In the final year of the Project, the foregoing activities were consolidated into training curriculums entitled “integrated pest control” and “management, conservation, fertility of soil” and these were proposed together with the “technical certification methodology” described hereafter.

In the latter part of the Project, the “technical certification methodology” concerning techniques for sustainable agriculture was proposed. Through written and field examinations, this aimed to evaluate the knowledge, skills and practical capacity for diffusion activities of technicians regarding techniques for sustainable agriculture, and certify technicians according to the three levels of beginner, intermediate and advanced. It was added to the activities of the Project at the time of the intermediate review as a concrete means of strengthening the training system for technicians. In accordance with the proposed methodology, 49 technicians out of 52 technicians in the target areas sat beginner level examinations in the two fields of “integrated pest control” and “management, conservation, fertility of soil and agroforestry,” and 47 of these received certification in both fields before the end of the Project.

In the interviews that were conducted in the ex-post evaluation, many counterpart persons said that the training inside and outside of Nicaragua had been effective, and that the field guidance by Japanese experts entailing analyzing and presenting solutions to problems on the spot had been very effective. According to the questionnaire with the technicians[11], more than 90% of the counterpart technicians rated the usefulness of the knowledge gained in the Project as “very high” or “high”. Moreover, approximately 80% responded that the training inside and outside of Nicaragua and the

[11] Questionnaires were sent to all of the 50 technicians of the INTA who were the counterparts in the target areas as well as 20 technicians selected randomly based on its list of members outside of the target areas, and responses were obtained from 28 and 19 technicians respectively (47 in total).

field guidance by Japanese experts had been “very useful,” while 20% rated it as “fairly useful” or “useful”.

Among the comments made by the technicians, they said the following: “Until the Project started, I thought that chemical fertilizers and agricultural chemicals were everything, and I did not trust organic agriculture at all. Now I know otherwise. The JICA Project has been like a school for us.” On accompanying the technicians on visits to farms, it could be seen that they have acquired ample capability to utilize techniques for sustainable agriculture in resolving the issues faced by farmers. At the time of the ex-post evaluation, many of the technicians who received certification in the Project were serving as instructors in training targeting farmers and extension officers in other government agencies.

In view of the above, it is deemed that the capacity of technicians in the target areas was improved greatly through the Project.

（３） Diffusion of techniques for sustainable agriculture (Output 3)

Diffusion activities by INTA were centered around making visits to individual farmers. However, activities in the demonstration farms, which have been conducted separately, were left to each technician in charge and not operated in an organized or efficient manner. In the Project, diffusion of techniques for sustainable agriculture to farmers in the target areas was conducted upon constructing an organized and efficient diffusion setup utilizing the PDCs that were developed from the conventional demonstration farms.

During the Project, a total of 227 PDCs were established in the target areas. The PDCs were established with the cooperation of farmers, and the technicians in charge conducted diffusion activities through distributing farm tools and materials, and conducting training and technical assistance for cooperating farmers, Practical Demonstrations and Field Day for local farmers, and Technical Exchange Trips between farmers based on a one-year plan of activities[12]. Following completion of the first year of activities, follow-up and evaluation of results were conducted for one or two more years. Since 10 or more local farmers on average participated in the activities in each PDC, it is estimated that more than 2,000 farmers have received diffusion of techniques[13]. Moreover, as teaching materials concerning the techniques for sustainable agriculture, 11 pamphlets, 17 posters, six manuals, etc. have been prepared and distributed to farmers. In the fourth year of the Project, a monitoring survey of the extension activities at PDCs was conducted, and the results were used in

[12] In the Practical Demonstrations, cooperating farmers and nearby farmers practiced and learned specific sustainable farming techniques under the guidance of the INTA technicians. In the Field Day, nearby farmers were invited to witness the results of the sustainable farming techniques and receive lessons with a view to promoting dissemination. At the Technical Exchange Trips between farmers, farmers were invited from nearby villages in order to exchange information and opinions on the practice of sustainable farming techniques, again with the aim of promoting diffusion.

[13] During the Project period, Practical Demonstrations were held a total of 476 times for 6,382 participants, while Field Days were staged 79 times for 2,228 participants, and Technical Exchange Trips were held nine times and gathered 265 participants.

reviewing the diffusion techniques. In the fifth year of the Project, the above activities were compiled into a PDC operating manual.

Since the goals of the diffusion activities have been achieved and conditions regarding the learning and application of techniques for sustainable agriculture among targeted farmers have been good, it is thought that adequate progress has been made concerning the acquisition of techniques for sustainable agriculture among small-scale farmers in the target areas[14].

3.2.1.3 Achievement of Project Purpose

Table 1 Degree of Achievement of the Project Purpose

Project Purpose	The diffusion system of sustainable agriculture of INTA is strengthened, and small-scale farmers in the target area initiate using the learned techniques. <Generally achieved>
Indicator	Results
① At least 50% of technicians receive technical certification in two or more techniques	By the end of the Project, 47 out of 52 technicians (90%) in the target areas received beginner level technical certification in two or more techniques. <Achieved>
② At least 70% of PDC farmers apply techniques for sustainable agriculture introduced by the Project	By the end of the Project, techniques for sustainable agriculture were being practiced at least by 151 out of 227 PDC farmers (67%, including 29 farmers practicing in their own fields after receiving training in the PDCs). <Generally achieved>

The project purpose was: "The diffusion system of sustainable agriculture of INTA is strengthened, and small-scale farmers in the target area initiate using the learned techniques." It was anticipated that the project purpose would be achieved through the preparation of techniques to diffuse for sustainable agriculture based on development and improvement of techniques (Output 1), the capacity strengthening of technicians (Output 2), and efficient diffusion activities centered on PDCs (Output 3).

As is indicated in Table 1, the degree of achievement was high regarding the two indicators set for the project purpose. According to the findings of the beneficiary survey[15], concerning the application of techniques (Indicator ②), since 93% of PDC farmers (farmers who own PDC and cooperated with the Project) are practicing the techniques for sustainable agriculture that were introduced in the Project at the time of the ex-post evaluation, it is highly possible that the degree of

[14] It was intended to establish 210 or more model fields with 2,100 or more participants. Concerning the application of techniques, see section 3.2.1.3 Achievement of the Project Purpose.

[15] In the ex-post evaluation, a questionnaire survey targeting farmers in the target areas was implemented as the survey of beneficiaries. The survey targeted 44 PDC farmers (randomly selected by allocating quotas to each municipality according to the INTA register) and 76 other farmers (37 farmers introduced by PDC farmers, and 39 farmers considered to be representative in the communities of PDC farmers), and comparative analysis was conducted between the benefiting farmers (97 farming households that received training in the Project or from INTA) and non-benefiting farmers (23 farm households that received no such training).

achievement at the completion of the Project was in excess of 70%[16]. Furthermore, although not included in the indicators, it can be said that strengthening of the sustainable agriculture diffusion system, which was part of the project purpose, was aided by two factors, namely 1) numerous diffusion materials giving an easy commentary on techniques for sustainable agriculture to farmers were prepared, and 2) a more organized and efficient diffusion system was established through utilizing the PDCs.

In view of the above, the Project largely achieved its purpose.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

The overall goal of the Project was: "Techniques for sustainable agriculture is diffused among small-scale farmers in the target areas." In specific terms, it was anticipated that 40% of the small-scale farmers that received technical transfer in the PDCs would be practicing techniques for sustainable agriculture by 2016 through continuous extension activities modeled in the Project in the target areas.

According to the findings of the beneficiary survey, 61% of indirect benefiting farmers (farmers who have received training or technical transfer from INTA but are not the PDC farmers) in the target areas utilize techniques for sustainable agriculture in some form or other. Moreover, according to a questionnaire survey with technicians (counterparts), they estimate that approximately 50% of PDC farmers and approximately 40% of nearby farmers (indirect benefiting farmers and non-benefiting farmers) are using techniques for sustainable agriculture in some form or other (these figures express the average values in the responses given by the technicians). Summing up, it is inferred that target level of the indicator (40% of the indirectly benefiting farmers are using some techniques for sustainable agriculture introduced by the Project) was achieved, therefore, the overall goal has been achieved.

[16] According to the Project completion report (March 2013), there were 122 farmers who were still continuing activities in the PDCs when the Project was finished. Furthermore, it was confirmed that 29 farmers who had received training in PDC were implementing sustainable agriculture autonomously. It is assumed that these 151 farmers were practicing sustainable farming techniques at the time of Project completion. In addition, out of 104 farmers who had completed PDC activities by the time the Project was completed, it is thought that some were still practicing sustainable farming techniques at the time of Project completion. According to a survey implemented during the Project (2012), approximately 90% of the farmers who had practiced sustainable farming techniques in the past were continuing to practice them. In view of these findings, it was concluded that "the ratio of continuing use of the techniques is high and the situation regarding application of techniques is good" in the terminal evaluation. Following Project completion, INTA support for PDC farmers was gradually finished. However, according to the beneficiary survey at the time of the ex-post evaluation, the techniques application rate was more than 90%, indicating the possibility that it was higher than the ratio of 70% at the time of Project completion.

Table 2 Degree of Achievement of the Overall Goal

Overall Goal	Techniques for sustainable agriculture are diffused among small-scale farmers in the target areas. <Presumed to have been achieved>
Indicator	Results
More than 840 small-scale farmers (40% of small-scale farmers) in the target areas practice techniques for sustainable agriculture by 2016.	61% of indirect benefiting farmers (farmers who have received training or technical transfer from INTA but are not PDC farmers) in the target areas utilize techniques for sustainable agriculture in some form or other. (According to the beneficiary survey)

Note: The small-scale farmers targeted by the above indicator are farmers who have received training on techniques for sustainable agriculture in PDCs. It was assumed that 10 farmers would receive training at each of the 210 PDCs, and that 840 farmers (40% of the total number) would practice the techniques.

According to the interviews in the field survey, almost all of the PDC farmers have retained and are utilizing the knowledge they have learned about techniques for sustainable agriculture over the extent that is necessary or possible for them. There have been striking success stories of farmers who have purchased additional land for vegetable cultivation, farmers who are retailing organic fertilizers and so on. The techniques are mostly utilized for cultivating vegetables. But, they are also utilized in cultivation of cereals, fruits, coffee and so on. However, in the south of the country, many farmers find it difficult to cultivate vegetables at all due to drought.

According to the results of the interviews with technicians and benefiting farmers and the beneficiary survey, the techniques for sustainable agriculture impart the following kinds of merits and their diffusion is being promoted by them. Among these, reduction of production costs is the most practical merit for accelerating the diffusion of techniques.

- Through utilizing materials such as remains of crops and old leaves etc. that can be acquired locally at the farm at no cost, use of chemical fertilizers and pesticides can be reduced. As a result;
  - Production costs can be reduced (cited by almost all the benefiting farmers).
  - Farmers who were previously unable to purchase chemical fertilizers and pesticides have been able to increase production and cultivate new crops (cited by 80% of benefiting farmers).
- Organically cultivated crops are recognized to be good for health and are popular in markets (cited by 70% of benefiting farmers).
- Due to reduction in use of pesticides, health damage has declined among producers (cited by almost all the benefiting farmers).

On the other hand, the following constraints on diffusion of techniques for sustainable agriculture can be seen.

- Availability of some of the materials that need to be purchased is limited; nursery tunnel materials, mineral for making liquid fertilizer (boron, molybdenum, etc. in order to supply as micronutrients), etc.
- Small-scale farmers lack the economic means to purchase the necessary materials.
- Since it takes time and effort to prepare organic fertilizer, it is hard to apply it to large-area crops (It is suitable for vegetables and fruits but not for cereals).
- Drought has continued for three years, making it difficult to cultivate vegetables in coastal areas and so on.


Vegetable fields of a benefiting farmer


(Left) Production and sale of worm fertilizer by a benefiting farmer
(Right) Preparation of organic fertilizer from coffee husks

3.2.2.2 Continuation of Activities following Completion of the Project

（１） Changes in the Organizational Structure of INTA

In 2012, the Government of Nicaragua established the Ministry of Family, Communal, Cooperative and Associative Economy and conducted organizational revamping placing all rural development infrastructure projects and extension activities including agricultural sector under the jurisdiction of this ministry. In line with this, the role of INTA was restricted to research and development and technical transfer (training) for producers, educational institutes and other governmental organizations responsible for extension activities, and it no longer conducted technical assistance through door-to-door visits to farmers. At the same time, a new term – an agricultural technique innovation and transfer technician – came to be used instead of an extension technician.

Technical transfer activities were previously managed by the research department. However, in order to strengthen the management of activities related to technical transfer, INTA established a new Technical Transfer Department.

（２） Development of techniques for sustainable agriculture (Output 1)

Concerning the development of techniques, following completion of the Project, techniques have been continuously developed and improved via field test of various kinds. Some achievements include; application of techniques originally developed for vegetables to staple crops, coffee, etc.; continuation of the tests started for fruits; practical application of the improved rice varieties that were introduced on a trial basis in the Project, etc.[17] Moreover, there are plans to improve some of the techniques via assistance from other donors.

（３） Capacity strengthening of technicians (extension officers) (Output 2)

Concerning the training of INTA technicians, the INTA regional offices compile the training needs and prepare annual training programs based on them. With respect to technicians in areas other than those targeted in the Project, similarly, training programs are implemented according to each area's annual training needs. INTA employees serve as the instructors, but training is sometimes consigned to universities. Concerning newly recruited technicians, in addition to the abovementioned training, on-the-job training is conducted by veteran technicians. There are no training programs for the small numbers of new recruits only[18].

According to INTA, it is not possible to use the training curriculum proposed in the Project as it

[17] In the Project, a sucker variety of paddy rice, which enables the environmental damage caused by slash and burn farming to be reduced, was introduced from the Republic of Dominica (sucker refers to a young shoot that grows from a tree stump or root). Following completion of the Project, validation tests for this was completed, and it is scheduled to be distributed during 2016 as an official improved variety.

[18] There is not a lot of turnover among the INTA researchers and technicians. However, following completion of the Project, some new technicians have been employed in the target areas. According to INTA, because universities have recently started teaching techniques for sustainable agriculture, even new recruits possess basic knowledge and are able to serve as training instructors after gaining two or three years of practical work experience.

is, while they are used as reference material for planning training programs, because the training needs are always changing according to time and place. Following completion of the Project, certification examinations for technicians have not been implemented and the technical certification methodology has not been used. According to the explanation given by INTA, its mandate does not include "certification of technical capacity"[19].

（4） Diffusion of techniques for sustainable agriculture (Output 3)

In the Project target areas, approximately 90% of the Project counterparts were continuously employed by INTA and were playing a major role in researching and transferring techniques for sustainable agriculture at the time of the ex-post evaluation. Furthermore, from 2014, the agricultural techniques handled by INTA were entirely changed to techniques for sustainable agriculture, and the development and transfer of such techniques came to be implemented over not just the Project target areas but the entire country[20]. Concerning the transfer and diffusion of techniques for sustainable agriculture, following completion of the Project, INTA has mainly been conducting activities by the following methods.

Demonstration Farms

Technical transfer to farmers' groups has been conducted based on the Demonstration Farms (officially called Technical Investigation and Innovation Farms), which were newly established from 2014. The contents and mechanism for operating the Demonstration Farms were established through developing the mechanism of PDCs that was established in the Project, although some Demonstration Farms are different in that they also include livestock, cover a larger area of farmland and entail five years of activities as standard (activities for the PDCs under the Project were for 2 – 3 years). Furthermore, because the Demonstration Farms can be used to conduct validation tests, which represents the final stage of technical development, they are the hubs for developing and diffusing techniques for sustainable agriculture. By 2015, approximately 600 Demonstration Farms had been established all over Nicaragua and INTA plans to further increase these from now on. In the Project target areas, some of the PDCs that were established in the Project are being utilized as Demonstration Farms. Activities at the Demonstration Farms include the demonstration and display of techniques for sustainable agriculture, practical demonstration and on-site trainings targeting nearby farmers, and so on. According to the interviews with technicians, although the manual for PDCs that was created in the Project has not been adopted as it is because the PDCs have been

[19] The National Technological Institute is the agency with official responsibility for certification. When the introduction of technical certification methodology was included in the plan at the time of mid-term review (October 2010), this point was not clearly recognized. After that it became obvious while examining such methodology in detail. The experts anticipated that by utilizing this in the evaluation of capacity of technicians, it could be used to help strengthen the training system.

[20] For this reason, the quantities of chemical fertilizers and agricultural chemicals purchased by INTA for research and diffusion purposes in 2015 were roughly one twentieth of the quantities in 2007.

changed to the Demonstration Farms, around 80% of the contents are being utilized on the demonstration farms.

Technical transfer to other agencies

Having inherited agricultural techniques extension activities from INTA, the Ministry of Family, Communal, Cooperative and Associative Economy has newly recruited extension officers and conducts extension activities for farmers and farmers' groups. The INTA researchers and technicians conduct training (indoor and practical training) for the Ministry's extension officers at its Technical Development Center, etc.

The Government of Nicaragua has been implementing the "Rural Technical School" program described on the following pages since 2014, and the researchers and technicians of INTA serve as lecturers in the training for extension officers and technicians that take part in the program from relevant agencies (National Technological Institute, Institute of Agricultural Protection and Safety [*Instituto de Protección y Sanidad Agropecuari*a], Ministry of Family, Communal, Cooperative and Associative Economy, Ministry of the Environment and Natural Resources [*Ministerio del Ambiente y de los Recursos Naturales*], Ministry of Agriculture and Live Stock [*Ministerio Agropecuario*], etc.).

The vocational schools run by the National Technological Institute conventionally had been teaching mainly agricultural technologies centered on chemical fertilizers and agricultural chemicals, but from 2013 onwards they also came to teach techniques for sustainable agriculture. Accordingly, lecturers in charge of agriculture at the National Technological Institute received training from INTA, and under guidance from INTA, established demonstration plot on the campus ground to teach techniques for sustainable agriculture.

Rural Technical School

The Office of the President started the program of Rural Technical School in 2014 and deploys technical training in rural communities all over the country. The National Technological Institute plays the central role in implementing the program. Technicians of the National Technological Institute and relevant agencies are developed as facilitators (instructors) and once a week for periods ranging from seven to nine months, conduct technical training for small-scale farmers and agricultural laborers based on classroom learning and practical training concerning topics such as introduction on natural resources, water and soil conservation and improvement, pest management, farm management and so on. In two years between 2014 – 2015, approximately 31,000 farmers, equivalent to 12% of all farmers in Nicaragua, received training of this kind.

The Rural Technical Schools exclusively deal with techniques for sustainable agriculture, and their teaching materials are prepared in cooperation with the National Technological Institute, INTA, other relevant agencies and universities. Each regional department has its own training team to

prepare facilitators. INTA researchers and technicians also join the training teams, while the INTA technicians also act as facilitators in some technical training.

3.2.2.3 Other Impacts

(1) Impacts among benefiting farmers in target areas

As was described in section 3.2.2.1 Achievement of the Overall Goal, many of the benefiting farmers who utilize the techniques for sustainable agriculture in the Project have reported merits such as reduction of production costs, increased production, cultivation of new crops (vegetables, etc.) and so on. Concerning the reduction of production costs, INTA has reported the cases where costs have actually been cut by between 20 – 40% and that this is the most practical merit supporting the introduction of techniques for sustainable agriculture.

In the field visit, it was found that yields of tomatoes, green peppers and other vegetables have increased because farmers are able to deal with pests without using pesticides, while some farmers who had previously abandoned the idea of vegetable cultivation have started growing vegetables. As striking examples, some farmers have learned vegetable cultivation for the first time in the Project and have used its profits to buy additional farmland, while other farmers have started producing worm fertilizer and liquid fertilizer in large quantities and selling it to nearby farmers. Thus, the Project has had an impact on such farmers in terms of improving income and quality of life. Additionally, there have been cases where vegetable farming that had been previously limited had displayed geographical expansion (Pacific South Zone), cases of large-scale farmers introducing vegetable nursery tunnels inspired by the introduction of the same by small-scale farmers (Central North Zone), cases where farmers who received training in PDCs formed groups to jointly purchase materials and start producing fertilizers, pest control materials and seedlings (Managua Zone) and so forth.

Moreover, in the beneficiary survey, almost all farmers said that limiting use of pesticides would contribute to improving the health of producers and consumers. The Government of Nicaragua established the Institute of Agricultural Protection and Safety in 2014 and has been conducting food safety initiatives for farm products including a mass media campaign aimed at raising awareness, and a similar heightening in awareness can be seen among farmers. However, apart from one instance in which a farmer no longer suffered from a skin rash caused by pesticides, no concrete examples have been confirmed.

Moreover, according to the interviews in the field surveys, crops (especially vegetables) that have been produced without using chemical fertilizers and pesticides are popular in markets and quickly sell out. However, because there is no certification system for organic products, the farmers are unable to differentiate prices[21]. As the market for organic crops becomes more established from

[21] In Nicaragua, organic certification is conducted by the private sector mainly with a view to exporting coffee, cacao and honey. However, there are no certification systems concerning other crops or domestic markets. The

now on, it is thought that the merits of techniques for sustainable agriculture will become even more widespread.

(2) Impact in areas other than the target areas

As was described in section 3.2.2.2 Continuation of Activities following Completion of the Project, INTA now only deals with techniques for sustainable agriculture on the national scale. Diffusion of sustainable agriculture is being practiced in 600 Demonstration Farms established throughout the country.

Additionally, in the vocational schools of the National Technological Institute and the National Program of Rural Technical School being implemented by the Office of the President, techniques for sustainable agriculture are handled in cooperation with INTA, thereby helping to diffuse them all over the country. In particular, in the latter of these programs, approximately 12% of all small-scale farmers in the country have received training about techniques for sustainable agriculture in three years, demonstrating the speed of diffusion taking place.

In this way, the Project has contributed to the nationwide diffusion of techniques for sustainable agriculture through enhancing INTA's capacity in that field.

(3) Linkage with other JICA technical cooperation projects

In Nicaragua, there are three technical cooperation projects in the agricultural sector linked to the Project, imparting the following kind of linkage and synergistic effects. In the "Project for Improvement of Living Standard through Promotion of the Farming Production in the Indigenous / Ethnic-Communities of Puerto Cabezas" (February, 2008 – February, 2013) and the "Project on Community Level Alliance for Strategical Implementation of Rural Development" (March, 2009 – March, 2013), the Project's contribution has only been partial and limited. However, in the "Vocational Training Improvement Project in Agricultural and Livestock Sector" (September, 2013 – September, 2018, under implementation), the Project counterparts have made an important contribution.

<u>Project for Improvement of Living Standard through Promotion of the Farming Production in the Indigenous / Ethnic-Communities of Puerto Cabezas</u>

In the city of Puerto Cabezas, which is located in the indigenous autonomous region on the Atlantic side of Nicaragua, the municipal government, university and NGOs have established a rural development committee to work on developing promoters, disseminating agricultural techniques to farmers' groups and improving livelihoods. While there is no INTA office in this area, the experts

---

Agricultural Ecological and Organic Production Promotion Law that was enacted in 2011 is a legal framework for an official organic farming market. However, according to INTA, no new certification agencies have been established based on this law, and the operating criteria are too stringent for many farmers. As a result, development of such a market has not yet been realized.

from both projects conducted regular exchange and promoted transfer of techniques for sustainable agriculture through conducting training for the local counterparts and promotors. As a result, some farmers were able to start cultivation of vegetables through the activities of this project. However, due to differences in soil and weather conditions, there were some situations where not all the techniques used in the Project could be applied as they are.

Project on Community Level Alliance for Strategical Implementation of Rural Development

Through forming and implementing model activities responding to the needs of target communities via a participation process based on linkage among local administrative agencies, agricultural cooperative associations, communities, etc. in the target areas (within the scope of target areas of the Project), this project aimed to build a system to facilitate collaboration between parties engaged in rural development. INTA technicians (the Project counterparts) conducted evaluation of farming potential, provided techniques for sustainable agriculture, supplied seeds and so on in the rural development model activities. It has been confirmed that the techniques for sustainable agriculture (organic fertilizer, mulch, etc.) introduced in this project continue to be utilized by the beneficiaries of these model activities.

Vocational Training Improvement Project in Agricultural and Livestock Sector

This project has been implemented with the objective of creating the education curriculums[22] and teaching materials for the agricultural sector at vocational schools run by the National Technological Institute and enabling the teachers of these schools to adequately conduct guidance on agricultural and livestock techniques at the schools. Some counterparts (INTA researchers and technicians) have participated in the technical committees charged with creating teaching materials and curriculums in each field, and they have made a technical contribution based on the knowledge and experience acquired in the Project. Moreover, the various materials (pamphlets, training resources) that were created in the Project concerning techniques for sustainable agriculture are being referred to.

(4) Social and environmental impacts

The techniques for sustainable agriculture are environmentally friendly agricultural techniques, and the Project has imparted favorable impacts on the natural environment through their diffusion. No negative impacts have been confirmed in terms of environment and society (resettlement of residents) and so on.

[22] There are 15 vocational schools in the agriculture field throughout the country.

Summarizing the evaluation on effectiveness and impacts of the Project, with the implementation of the Project, the project purpose "the diffusion system of sustainable agriculture of INTA is strengthened, and small-scale farmers in the target area initiate using the learned techniques" has been generally achieved. In terms of the overall goal as well, effects have been realized as planned and the impact has been far reaching. Therefore, the effectiveness and impact of the Project are high.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

The planned and actual inputs by the Japanese and Nicaraguan sides to the Project are outlined in the following table.

Table 3 Comparison of Planned and Actual Inputs in the Project

Inputs	**Plan**	**Actual** (at the time of project completion)
Japanese Side		
(1) Dispatch of experts	3 long-term experts (180 person-months), some short-term experts	6 long-term experts (145 person-months), 4 short-term experts (35 person-months) (general management, cultivation techniques, organic fertilizer, diffusion, training, work coordination)
(2) Trainees received	A few trainees each year	Training in Japan: 12 trainees Third country training: 60 trainees
(3) Provision of equipment	Vehicles, training equipment and materials, construction of facilities, etc.	Vehicles, motor cycles, ploughing machines, PC, printer, copier, projector, etc.
(4) Operational expenses	Training, creation of reference and teaching materials, survey, preparation of PDCs, etc. (scheduled cost unknown)	Training, creation of reference and teaching materials, survey, preparation of PDCs, etc. (624,000USD)
Japanese side Total Project Cost	Total approximately 310 million yen	Total 382 million yen
Nicaragua side		
(1) Assignment of counterparts	30 persons	70 persons
(2) Others	Experts' offices, furniture, stationery, other work expenses	Provision of Project offices, storage, meeting rooms, etc.
(3) Project overheads	Fuel cost, office expenses, diffusion expenses, business travel expenses, etc.	Fuel cost, office expenses, diffusion expenses, business travel expenses, etc.: 14,000USD (estimate as of September 2012)

Source: Created based on materials provided by JICA

3.3.1.1 Elements of Inputs

While the long-term experts were replaced midway through the Project, the Japanese experts were dispatched more or less as planned. INTA generally assessed the experts to have high capacity. The number of assigned counterparts was 70, far more than planned, and 60 of these took part in third country training that was not specified in the plan. The basic capacity of INTA researchers and technicians was high, and the large increase in the dispatched number of counterparts targeted for capacity building helped enhance the efficiency of the Project. Equipment supply on the Japanese side went almost exactly as planned and was appropriate.

According to the Terminal Evaluation report and interviews with the experts and counterparts, it is deemed that efficiency of implementation of the Project was affected by the following conditions.

- In the second year of implementation, there was a change of target crops from fruits to staple crops. Accordingly, the outputs from the earlier fruit initiatives were not realized, while the time spent on initiatives for staple crops was shorter than the full five years of the Project, meaning that efficiency was somewhat diminished as a result.

- At the beginning of the Project (1st and 2nd year), communications between the Japanese experts and some counterparts on the central office level were inadequate, and there was a period when organized activities could not be realized as a result. Moreover, the joint coordinating committee was staged for the first time towards the end of the second year of the Project. In the Terminal Evaluation, it was pointed out as the background of the above that the experts had failed to make a sufficient effort to build common understanding among the stakeholders concerning the activities implemented according to the Project's planning framework.

- Apart from the period described above, communications between the Japanese experts and counterparts were extremely smooth; the activities proceeded well, and many positive outputs were achieved as mentioned earlier. Factors behind this were as follows: communication skill of the newly appointed experts were high, all the counterparts actively engaged in the Project activities encouraged by government and INTA policies of encouraging sustainable agriculture, and numerous experts who had experience of similar technical cooperation in other Latin American countries participated in the Project. INTA thought that the on-the-job training in field, in which experienced experts visited farmers together with the counterparts, was extremely effective and unique to the Project as opposed to other donor projects.

3.3.1.2 Project Cost

The total Project cost for the Japanese side was originally planned to be approximately 310 million yen. The actual cost of 382 million yen exceeded the planned cost (123% of the planned cost). As there was not a huge cost over-run and the details of the planned cost are unknown, it was impossible to determine the reasons for this cost over-run.

3.3.1.3 Period of Cooperation

The planned project period was 60 months from November, 2007 to November, 2012. The commencement of the Project was delayed by four months; nevertheless, the Project was completed over the originally planned 60 months from March, 2008 to March, 2013.

Summing up, some aspects of the Project activities were inefficient and, although the Project was implemented within the originally planned period, the Project cost exceeded the plan. Therefore, efficiency of the Project is fair.

3.4 Sustainability (Rating: ③)

3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects

As already mentioned in 3.1 Relevance, the promotion of sustainable agriculture was a priority area of policy at the time of the project completion, and is still a priority area of policy at the time of ex-post evaluation. Policies in recent years have placed emphasis on the introduction of techniques for the conservation and sustainable management of natural resources such as land and water and the introduction of environmentally friendly techniques. In response to this, INTA has completely changed the focus of the agricultural technologies it handles, shifting from conventional agriculture that relies on large quantities of chemical fertilizers, pesticides and herbicides to sustainable agriculture, and it is now continuing the development and technical transfer (diffusion) of techniques for sustainable agriculture over the entire country at the time of ex-post evaluation as explained in the section on Impact. Accordingly, the Project is deemed to have high sustainability in policy and institutional aspects.

3.4.2 Organizational Aspects of the Implementing Agency for the Sustainability of Project Effects

With establishment of the Ministry of Family, Communal, Cooperative and Associative Economy in 2013, all extension activities in the various fields in rural areas were placed under the jurisdiction of this ministry, and INTA ceased to conduct technical support through door-to-door visits to farmers. However, diffusion of techniques via the PDCs that were started in the Project is being continued as technical transfer based on Demonstration Farms. Moreover, in order to strengthen technical transfer activities to other organizations, demonstration farms, etc., it has

established Technical Transfer Departments in its headquarters and regional offices and constructed a system in which dedicated employees conduct management of technical transfer activities that was previously conducted concurrently by researchers.

On the other hand, concerning research in the agricultural field, in order to conduct research and diffusion of research outputs more efficiently and effectively through strengthening links between government agencies (including INTA), universities, producers (farmers), production cooperatives and so on, the government has established the “National Agricultural Research System” as an institutional framework.

In this way, concerning the extension activities of INTA, the setup for continuing technical transfer activities based on the Demonstration Farms, and the system for advancing the diffusion of techniques going beyond the organization framework have been strengthened. Accordingly, the Project sustainability in organizational aspects is high.

3.4.3 Technical Aspects of the Implementing Agency for the Sustainability of Project Effects

The retention rate of INTA researchers and technicians is high, with more than 90% of counterparts in the Project target areas continuing to work at INTA at the time of the ex-post evaluation. The INTA researchers and technicians in general have high interest in technology, and more than half of the Project counterparts can perform technical transfer to other agencies. Some of the counterparts are working with university professors, etc. on the technical committee charged with revising the education curriculums and teaching materials of the National Technological Institute. The high level of interest and technical capability of the counterparts were sensed from the responses to the interviews.

INTA implements training for technicians every year. The regional offices judge the necessity of training programs, make applications to headquarters, and implement the training that has been approved. There are few new recruits and no special training is conducted for rookie technicians, but new recruits slowly learn from veterans on-the-job. According to the technicians and so on, even new recruits become able to serve as instructors in rural technical colleges after two or three years’ experiences in field.

According to the questionnaire survey with technicians, the non-counterpart technicians (those in areas not targeted by the Project) are relatively inferior to the counterparts in terms of degree of training and ability concerning techniques for sustainable agriculture (Table 4). Since the non-target areas have no opportunities for overseas training or on-the-job training by experts such as was implemented in the Project, they do not benefit from the training effects.

Table 4 Degree of Training and Knowledge of INTA Technicians concerning Sustainable Agriculture

	Technicians in target areas (counterparts)	Technicians outside of target areas
Have received training in techniques for sustainable agriculture following the Project completion	36%	11%
Possess adequate knowledge on techniques for sustainable agriculture	89%	32%

Source: Questionnaire survey of INTA technicians
(28 technicians in target areas, 19 technicians outside of target areas)

Following completion of the Project, INTA has printed additional copies of the training and diffusion materials that were created in the Project; has distributed them and utilizes them in diffusion activities. According to the questionnaire survey with technicians, 85% of the counterparts still have the manuals that were created in the Project (two manuals: "Preparation of organic fertilizer and liquid fertilizer" and "Diagnosis of the main diseases of vegetables"), and 63% of counterparts still use them. Also, more than 80% of counterparts are able to utilize the training and diffusion materials (11 pamphlets, 17 posters, 6 manuals, etc.) that were created in the Project, and 90% of them rate their usefulness very highly.

Summing up, the counterpart researchers and technicians have displayed sufficiently high technical capability and retention rate; the manuals and teaching materials that were created in the Project are utilized, and the technical development and the abovementioned diffusion activities continue to be implemented (also see section 3.2.2.2 Continuation of Activities following Completion of the Project). Accordingly, technical sustainability of the Project is maintained in the target areas. However, in order for sustainable agriculture to further spread all over the country, ample capacity building will be necessary in areas other than the Project target areas.

3.4.4 Financial Aspects of the Implementing Agency for the Sustainability of Project Effects

INTA covers the general administrative expenses including personnel costs out of its own budget, although it depends on donors and other agencies to finance its activities budget[23].

The Demonstration Farm activities that were started in 2014 (see section 3.2.2.2 Continuation of Activities following Completion of the Project) extend the Project outputs over the entire country in a more developed form, and enough funds to finance activities up to 2017 have been secured through assistance from the Inter-American Development Bank[24]. Even after this assistance is finished, INTA plans to continue developing techniques for sustainable agriculture and to maintain

[23] According to INTA, at the time of the ex-post evaluation, INTA was implementing 25 or more donor projects, and the combined budget of these was equivalent to roughly 80% of the INTA activities budget.
[24] Program for Productivity Promotion of Sustainable Agriculture

activities at the Demonstration Farms as nationwide hubs for conducting development and diffusion activities.

Since the Demonstration Farm activities are the main responsibility of the technicians, so long as technicians are employed by INTA, it is likely that activities at the Demonstration Farms will be continued regardless of whether or not donor funding is available. Considering the fact that the government places high priority on sustainable agriculture and INTA has come to fully be engaged in sustainable agriculture, it is highly likely that a budget for activities will continue to be secured even after the aforementioned assistance by the Inter-American Development Bank comes to an end. Also considering that various activities are being continued and extended following completion of the Project, it is judged that financial sustainability is on the whole high.

Summing up, no major problems have been observed in the policy background and the organizational, technical, financial aspects of the implementing agency. Therefore, sustainability of the project effects is high.

4. Conclusions, Lessons Learned and Recommendations

4.1 Conclusions

The Project was implemented to strengthen the diffusion system on sustainable agriculture of the INTA and initiate the application of learned techniques by small-scale farmers in the Central North, Pacific South and Managua zones of Nicaragua, with the overall goal of diffusing sustainable agriculture among small-scale farmers in these areas. At the time of both planning and project completion, the introduction of techniques for sustainable agriculture was found to be highly consistent with the Government of Nicaragua's development policies and of high necessity. Moreover, since it was consistent with Japan's aid policies, the Project is highly relevant. The project purpose was largely achieved, and it is surmised that the overall goal was also attained. Furthermore, following completion of the Project, INTA had started widely promoting the techniques for sustainable agriculture and there has been an extensive impact; therefore, the effectiveness and impact of the Project are high. The Project period was within schedule; the activities on the whole proceeded smoothly; and the technical transfer by the Japanese experts was conducted effectively. However, because the project cost exceeded the planned amount, efficiency of the Project is fair. Sustainability of the Project in terms of policy, organization and technology is high. In financial terms, INTA has a high degree of dependence on donors. However, it is expected that activities in the demonstration farms that utilize the results of the Project will be continued even when the donor assistance comes to an end. Accordingly, sustainability of the Project is high.

In light of the above, the Project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

Recommendations to INTA

- In order to further strengthen the capacity of technicians regarding sustainable agriculture outside of the Project target areas, INTA will need to strengthen training for them. In addition to fully referring to the curriculums, technical certification methodology, manuals and teaching materials that were created by the Project, it is desirable to provide training that combines classroom training with practical training while seeking cooperation from the counterparts who acquired greater capacity thanks to the guidance of the experts in the Project.
- In light of the fact that channels for acquiring the materials needed to apply techniques for sustainable agriculture are limited, INTA should examine ways of establishing distribution channels for such materials targeting small-scale farmers.

4.2.2 Recommendations to JICA

- To ensure the further diffusion and utilization of the results for sustainable agriculture in the Project, JICA should examine the possibility of conducting technical cooperation with specific targets, for example, production, processing and retailing of vegetables and fruits; development of techniques for responding to climate change (drought); capacity building of INTA technicians and so on.

4.3 Lessons Learned

Technical cooperation that is timely and pertinent to needs has a greater impact

There is a greater possibility that activities will continue following the end of technical cooperation and contribute to a bigger impact if technical cooperation that is timely and fits well with policy and development needs is implemented and the planned effects are realized. The Project was consistent with the policies of the Government of Nicaragua and its implementation coincided with a major shift towards sustainable agriculture by INTA and produced the results that had been anticipated. Moreover, following the completion of the Project, INTA has been entirely devoted to diffusing sustainable agriculture and the Project outputs have been widely utilized. Furthermore, techniques for sustainable agriculture have been newly adopted in the national program on Rural Technical School and the nationwide network of vocational schools that are operated by the National Technological Institute, and INTA has been able to contribute to this while utilizing the capacity acquired through the Project.