Madagascar

Ex-Post Evaluation of Japanese Technical Cooperation Project

"The Aquaculture development Project in the Northwest Coastal Region of Madagascar"

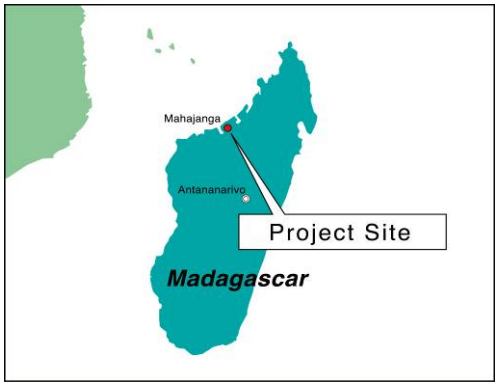
External Evaluator: Koichiro Ishimori, Value Frontier Co., Ltd

0. Summary

This project intended to develop shrimp aquaculture technologies at Shrimp Culture Development Center (CDCC) for the purpose of promoting the growth of small-scale[1] Penaeus Monodon aquacultures (i.e., the so-called black tiger shrimp). The objective of the project was in line with the development policies of Madagascar and Japan, as well as with the development needs of Madagascar at the time of the project's planning. However, it was not partially in line with the development needs at the time of the project's completion. Therefore, relevance is fair. The project improved CDCC's technical capabilities and successfully developed shrimp aquaculture technologies for small-scale farmers. However, because of a slump that occurred in international shrimp prices, all small-scale farmers withdrew from the shrimp market. In addition, both the project and the government of Madagascar struggled to continue the extension and promotion of shrimp aquaculture activities, resulting in no small-scale farmers entering the market. Consequently, no small-scale farmers are engaged in aquaculture activity. Therefore, none of the project's intended impacts was realized. Project cost exceeded the planed costs. The project period significantly exceeded the planned project period. Therefore, efficiency is low. The government of Madagascar still faces difficulties in extending or promoting small-scale shrimp aquaculture activities due to the slump of international shrimp prices. In addition, these activities are not well-supported by other policies. Therefore, sustainability of the project effects is low.

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

1. Project Description



Project location

Aquaculture ponds

[1] The government of Madagascar classifies aquaculture scales less than 50 ha in size as small-scale and scales more than 50 ha in size as large-scale.

1.1 Background

Marine fishing of Penaeus Monodon in Madagascar contributed to the national and regional economy by providing opportunities to earn foreign currency and create jobs. However, its marine resource decreased because of excessive fishing. For this reason, the government of Madagascar attempted to develop Penaeus Monodon aquaculture but it lacked the facilities and technologies to succeed. Therefore, it requested assistance from the government of Japan to implement "the project for constructing Shrimp Culture Development Center in Madagascar" based on Grant Aid Assistance. CDCC facilities were constructed in 1996. However, it continued to lack required technologies. Therefore, it again requested that the government of Japan implement this technical cooperation project.

1.2 Project Outline

Overall Goal		Sustainable shrimp aquaculture by small-scale farmers is promoted in the northwest region of Madagascar.
Project Objective		CDCC's technical capabilities to develop aquaculture adjusted to the local environments and conditions are improved.
Outputs	Output 1 (original period)	Seed production technology is improved.
	Output 2 (original period)	CDCC staff can efficiently carry out seed productions.
	Output 3 (original period)	Shrimp aquaculture methods adjusted to local environments and conditions are indentified
	Output 4 (original period)	CDCC staff can carry out extension and promotion activities of shrimp aquaculture.
	Output 5 (original period)	CDCC's management is improved.
	Output 6 (extended period)	Pond management for small-scale shrimp aquaculture is developed.
	Output 7 (extended period)	Feed development for small-scale shrimp aquaculture is improved.
	Output 8 (extended period)	Epidemic disease prevention measures for small-scale aquaculture are improved
Inputs		【Japanese side】 1. 25 Experts (original period) 6 for Long-Term; 14 for Short-Term; (extended period) 1 for Long-Term; 4 for Short-Term 2. 11 Trainees received (original period) 11 trainees; (extended period) 0 trainee 3. 0 Trainee for Third-Country Training Programs

	4. Equipment 128.38 million yen (original period) 117.13 million yen; (extended period) 11.25 million yen 5. Local Cost 103 million yen (original period) 89 million yen; (extended period) 14 million yen 【Madagascar side】 1. 17 Counterparts 2. Local Cost 75 million yen (wages for counterparts, training, etc)
Total cost	917.1 million yen (original period) 813.15 million yen; (extended period) 103.95 million yen
Period of Cooperation	April 1998 – May 2006 (original period) April, 1998 – March, 2003; (extended period) December, 2003 – May, 2006
Implementing Agency	Shrimp Culture Development Center（Centre de Developpement de Culture de Crevette: CDCC）
Cooperation Agency in Japan	Ministry of Agriculture, Forestry, and Fisheries
Related Projects (if any)	The project for constructing Shrimp Culture Development Center in Madagascar (1996) of Grant Aid Assistance

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement of Overall Goal

The terminal evaluation of the project in 2003 judged that it was too early to argue whether overall goal would be achieved. The terminal evaluation of the follow-up project in 2006 judged that it would be difficult to achieve overall goal in a short period because of the slump that occurred in international shrimp prices.

1.3.2 Achievement of Project Objective

The terminal evaluation of the project in 2003 judged that it was likely that the project objective would be achieved, though pond management, feed development, and epidemic disease prevention measures required fortification. The terminal evaluation of the follow-up project in 2006 judged that pond management, feed development, and epidemic disease prevention measures were fortified. Therefore, the project objective was achieved.

1.3.3 Recommendations

The terminal evaluation of the project in 2003 emphasized the importance of the

domestic development of inexpensive feed to promote small-scale aquaculture adjusted to the local environments and conditions because procurement costs for feed produced in foreign countries were major contributions to excessive total costs. Therefore, the follow-up project developed feed suitable for domestic production under output 7.

It also highlighted the importance of the extension of aquaculture technologies at the pilot farm and the establishment of a promotion system at CDCC that would provide continuous training related to extension and promotion. The follow-up project carried out extension activities related to aquaculture technologies at the pilot farm. However, it did not establish a promotion system because the project struggled to continue extension and promotion activities related to shrimp aquaculture because of the slump that occurred in international shrimp prices.

The terminal evaluation of the follow-up project in 2006 pointed out that CDCC should diversify the types of aquaculture it engages in. In particular, it recommended that CDCC engage in the production of tilapia to encourage maximum use of CDCC facilities and to meet local needs. CDCC has been working on tilapia aquaculture since 2011 with the assistance of a new technical cooperation project called "Rural Development Project through the Diffusion of Aquaculture of Tilapia in the Region of Boeny, Mahajanga".

2. Outline of the Evaluation Study

2.1 External Evaluator

Koichiro Ishimori, Value Frontier Co., Ltd

2.2 Duration of Evaluation Study

The ex-post evaluation study was implemented according to the following schedule:

Duration of the Study: November, 2012 – October, 2013

Duration of the Field Study：February 2nd, 2013 – February 17th, 2013

May 17th, 2013 – May 26th, 2013

3. Results of the Evaluation (Overall Rating：D[2])

3.1 Relevance (Rating：②[3])

3.1.1 Relevance to the Development Plan of Madagascar

The national development plan at the time of the project's planning, the Charter on Economic Policy of Madagascar Government (1992), aimed to develop socioeconomic environments suitable for aquaculture based on the development of socioeconomic

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

[3] ③: High, ② Fair, ① Low

environments and the promotion of private companies, as one of its 3 priorities. In addition, the sector plan at the time, the Plan for Aquaculture Development (1992), aimed to implement a project focused on the development of shrimp aquaculture as one of its 39 aquaculture projects. It prioritized the promotion of small-scale shrimp aquaculture by constructing facilities and engaging in the capacity building of aquaculture technologies at CDCC.

The national development plan at the time of the project's completion, the Madagascar Action Plan (2006), aimed to improve production technologies for agriculture, forestry, and fisheries industries under the section of rural development and a green revolution, as one of its 8 priorities. In addition, the sector plan at the time, the Master Plan on Aquaculture (2003), encouraged increased production of aquaculture, including shrimp aquaculture, for the purpose of providing opportunities to earn foreign currencies and create jobs. Therefore, the promotion of shrimp aquaculture was prioritized.

Ultimately, the project was in line with the development plan and sector plans in Madagascar—at both the time of the project's planning and its completion—and is judged to be relevant.

3.1.2 Relevance to the Development Needs of Madagascar

Madagascar's marine products, and, particularly, natural Penaeus Monodon, were the largest type of export goods. They supported national and regional economies because they provided opportunities to earn foreign currencies[4] and maintain employment[5] at the time of the project's planning. However, many believed that the catchment volume of natural Penaeus Monodon had already reached its sustainability level. Therefore, an increase in Penaeus Monodon aquaculture was required to compensate for catchment volume that could no longer be expected. In addition, because the international price of Penaeus Monodon increased from $12.1/kg in 1992 to $14.5/kg at the time of project's planning in 1996, approximately 15 small-scale farmers had initiated procedures to gain approval of their aquaculture activities. Therefore, the project that aimed to promote small-scale shrimp aquaculture was in line with the development needs of Madagascar at the time, and is judged to have been necessary.

Madagascar's marine products, and, particularly, natural Penaeus Monodon, continued to be the largest type of export goods. They supported national and regional economies by providing opportunities to earn foreign currencies[6] and maintain employment[7] at the

[4] Marine products accounted for approximately $68 million and 15% of the total amount of exports in 1996.
[5] Approximately 8,200 people were employed in 1996.
[6] Marine products accounted for approximately $51 million and 5% of the total amount of exports in 2006.
[7] Approximately 8,800 people were employed in 2006.

time of the project's completion. The catchment volume of natural Penaeus Monodon reached its peak of 9,823 tons in 2002 and decreased to 6,385 tons at the time of the project's completion in 2006. Therefore, Penaeus Monodon aquaculture was required to support the economy. Meanwhile, the international price of Penaeus Monodon decreased from its peak of $17.4/kg in 2000 to $11.6/kg at the time of the judgment of whether the project should be continued or not in 2003. The price decreased further to $10.4/kg at the time of the project's completion in 2006. Because of decreasing international prices, existing small-scale farmers started withdrawing from the market. Newcomers who had obtained approval for their aquaculture activities started avoiding entry into the market in the middle of the project around 2004. Consequently, when the project was completed, there were only three small-scale farmers and their promotion activities were limited. This situation differed significantly from the expected situation where aquaculture technologies developed by the project were fully utilized[8]. Therefore, the project that aimed to promote small-scale aquacultures through the development and promotion of aquaculture technologies was not partially in line with the development needs of Madagascar at the time of the project's completion.

In sum, while the project was meeting the development needs at the time of the project's planning, it was not partially meeting them at the time of the project's completion, and therefore the necessity of the project was judged to be fair.

3.1.3 Relevance to Japan's ODA Policy

The Charter on Official Development Policy (ODA) (1992) at the time of the project's planning highlighted, as one of its five priorities, the importance of "providing research cooperation leading to the building of technical capabilities of developing countries in research and development and applications" to encourage efforts to build technical capabilities including human resources development and research. In addition, the Policy Dialogues between Madagascar and Japan (1997) highlighted, as one of its four priorities, the importance of "promoting fisheries" to support agriculture, fisheries, and the environment.

In conclusion, this project was partly irrelevant with the country's development needs, and therefore its relevance is fair.

3.2 Effectiveness and Impact[9] (Rating:①)

[8] By 2009, the remaining three small-scale farmers had also withdrawn from the market. At the time of the ex-post evaluation study, no small-scale farmer remained (see Impact for details).

[9] A sub-rating for Effectiveness is considered in conjunction with Impact.

3.2.1 Effectiveness

3.2.1.1 Project Output

1） Output 1 (Original period): Seed production technology is improved

①Production volume and the production rate for postlarva Penaeus Monodon

Table 1: Production volume and the production rate for postlarva Penaeus Monodon[10]

	Plan	1999	2000	2001	2002	2003	2004	2005	2006
Production volume (10,000)	1,000	504	1,191	1,782	1,292	332	628	87	22
Production rate (%)*	100	50	119	178	129	33	62	8	2

*Actual production volume / Planned production volume (10 million/year) ×100
Source: CDCC

While the planned production volume of postlarva Penaeus Monodon at the time of the project's planning in 2006 was 10 million, the actual production was 0.22 million. Between 1999 and 2002, foreign-owned, large-scale companies and local small-scale farmers placed orders for postlarva Penaeus Monodon with CDCC. Therefore, actual production volumes exceeded the planned production volumes. After 2003, however, foreign-owned, large-scale companies started producing it at their own seed production facilities and did not place orders with CDCC. In addition, the total volume demanded by local small-scale farmers was small. Consequently, after 2003, actual production volume was lower than the planned production volumes. Hence, the planned production rate and actual production rates were similar. Therefore, ① is judged to have been partially achieved.

②Survival rates for postlarva Penaeus Monodon

Table 2: Survival rates for postlarva Penaeus Monodon

	Plan	1999	2000	2001	2002	2003	2004	2005	2006
Survival rate	>55%	43%	46%	56%	73%	56%	62%	35%	32%

Source: CDCC

While the planned survival rate of postlarva Penaeus Monodon at the time of the project's planning in 2006 was 55% or higher, the actual survival rate was 32%. Between 1999 and 2002, the average actual survival rate was 55% for the same reason mentioned above and similar to the reasons stated for planned survival rates. After 2003, however, foreign-owned, large-scale companies did not place orders with CDCC. Local small-scale farmers continued to place orders, but their orders were primarily placed during the rainy season that extends between

[10] The project has separately set indicators of "production volume" and "production rate", but they mean the same thing in essence. Therefore, this ex-post evaluation study integrated them into one indicator.

January and April. This seasonal concentration contributed to the decline in the actual survival rate. Sea water brought to the facilities for the production of postlarva Penaeus Monodon at CDCC was qualitatively inappropriate for its production because it contained significant amounts of red clay that had drained from the rivers into the sea as well as sea water that had less salinity due to freshwater that had drained from the rivers into the sea. Consequently, the actual survival rate was lower than the planned survival rate. Therefore, ② is judged to have been partially achieved.

③Development of manuals and related documents

As the output related to seed production, the project produced "A manual for seed production" to be used by CDCC counterparts. CDCC produced seed based on the manual as planned during the project period. Therefore, ③ is judged to have been achieved.

In conclusion, it is judged that the project improved CDCC's seed production technology because, on average, it produced 11.92 million seeds, a 119% production rate and a 55% survival rate, albeit temporarily. However, the achievement rates for these three indicators at the time of the project's completion in 2006 were all low. Therefore, output 1 is judged to have been partially achieved.

2) Output 2 (Original period): CDCC staff can efficiently carry out seed production.

①Improvement of seed production technology for promotion

CDCC staff acquired knowledge and skills related to seed production for small-scale farmers through their OJT and manuals created by the project. Consequently, on average, they achieved a 119% production rate and a 55% survival rate, albeit temporarily. However, as mentioned above, the production and survival rates at the time of the project's completion in 2006 were lower than planned rates. Therefore, ① is judged to have been partially achieved.

②Development of manuals and related documents

As the output related to seed production for small-scale farmers, the project produced seed production manuals to be used by CDCC counterparts (e.g., "A manual for the use of aquaculture technologies for small-scale farmers" and "A manual for the development of Penaeus Monodon aquaculture with low stocking density for small-scale shrimp farms in northwest coastal region of Madagascar"). CDCC produced seed for small-scale farmers based on theses manuals and related

documents as planned during the project period. Therefore, ② is judged to have been achieved.

In conclusion, it is judged that CDCC counterparts were able to efficiently carry out seed productions because they acquired knowledge and skills related to seed production for small-scale farmers and created manuals. However, production and survival rates at the time of the project's completion in 2006 were lower than planned rates. Therefore, output 2 is judged to have been partially achieved.

3) Output 3 (Original period): Shrimp aquaculture methods adjusted to local environments and conditions are indentified

①Level of seed production and shrimp aquaculture technology achieved by counterparts and technicians

Counterparts and technicians conducted five times of extensive shrimp aquaculture, seventeen times of semi-incentive shrimp aquaculture, five times of grow-out shrimp breeding, and one time of grow-out shrimp intermediate breeding. As a result, they identified that profitability of semi-incentive shrimp aquaculture was higher than that of extensive shrimp aquaculture, and that semi-incentive shrimp aquaculture methods were suitable for local environments and conditions.

The terminal evaluation of the project (2003) pointed out the importance of the local development of inexpensive shrimp bait to promote small-scale shrimp aquaculture because the procurement costs for overseas shrimp bait accounted for a large part of the total costs of shrimp aquaculture. Therefore, the project worked on the local development of inexpensive shrimp bait as output 7 during the extended period and successfully developed it by the end of the project. Therefore, ① is judged to have been achieved.

②Development of manuals and related documents

As the output related to small-scale shrimp aquaculture methods adjusted to the water and habitat environments in Mahajanga, the project produced manuals and related documents to be used by CDCC counterparts (e.g., "A handbook of Phytoplankton collected in Mahajanga waters" and "A handbook of harmful fish found in the shrimp aquaculture ponds"). CDCC performed aquaculture based on these manuals and related documents as planned during the project period. Therefore, ② is judged to have been achieved.

In conclusion, it is judged that small-scale shrimp aquaculture methods adjusted to

local environments and conditions were indentified because the project identified semi-incentive shrimp aquaculture as a more profitable method than extensive shrimp aquaculture and produced manuals and related documents after it conducted numerous tests. In addition, the project worked on the local development of inexpensive shrimp bait as output 7 during the extended period because overseas shrimp bait was expensive. Thus, it was deemed inappropriate for local conditions. Therefore, output 3 is judged to have been achieved.

4) Output 4 (Original period): CDCC staff can carry out extension and promotion activities of shrimp aquaculture.

①The number of trainings

CDCC staff conducted four trainings for fisheries bureau staff and eight trainings for small-scale shrimp farmers, in total 12 trainings between 2000 and 2002. The four trainings provided for fisheries bureau staff focused on general aquaculture for the duration of one week. The six trainings provided for small-scale shrimp farmers focused on seed production and aquaculture conducted in ponds for the duration of four weeks. The two trainings provided for small-scale shrimp farmers focused specifically on aquaculture conducted in ponds for the duration from eight weeks to twelve weeks. The number of trainings provided appeared to be sufficient. Therefore, ① is judged to have been achieved.

②The number of trainees

45 fisheries bureau staff and 143 small-scale shrimp farmers, in total 188 people participated in trainings on aquaculture. Because five small-scale shrimp farms that already existed in 2003 hired approximately 300 employees, the number of trainees who participated in trainings equaled more than half of the total target. Therefore, ② is judged to have been achieved.

③Training quality

One trainee who participated in one of the trainings developed an aquaculture pond and obtained approval to engage in aquaculture. Therefore, training quality was considered as high.

Meanwhile, the terminal evaluation of the project (2003) noted the importance of not only conducting the above-mentioned trainings, but also carrying out extension activities at aquaculture ponds and developing a promotion system to provide continuous training related to pond management, bait development, and epidemic disease prevention to achieve training objectives (i.e., to promote shrimp

aquaculture technologies). During the extended period, the project carried out extension activities at an aquaculture pond. However, it did not develop a system to provide continuous training because the project struggled to promote small-scale shrimp aquaculture due to the slump that occurred in international shrimp prices at the time. Therefore, ③ is judged to have not been achieved.

④Development of manuals and related documents

As the output related to promotion of small-scale shrimp aquaculture, the project produced manuals and related documents to be used by CDCC counterparts (e.g., "A manual for preparation of aquaculture ponds" and "A manual for water control at aquaculture ponds"). CDCC carried out extension activities at a pilot farm based on the manuals and related documents as planned during the project period. Therefore, ④ is judged to have been achieved.

In conclusion, the project carried out extension activities at a pilot farm, but did not develop a system to provide continuous training because it struggled to promote small-scale shrimp aquaculture because of the slump that occurred in international shrimp prices at the time. Therefore, output 4 is judged to have not been achieved.

5) Output 5 (Original period): CDCC's management is improved

①Activity plans of CDCC and their performance

At a joint coordinating committee held in November 2005, it was decided that a steering committee comprised of Secretary General of Ministry of Agriculture, Livestock, and Fisheries (MALF), Director of Direction of Fisheries and Halieutic Resources of MALF, Director of Rural Development in Mahajanga, Director of Fisheries in Mahajanga, and Director of CDCC was created to support CDCC's activities at central and local levels. Consequently, CDCC started making activity plans and monitoring their performances on a yearly basis. With respect to uncompleted activities, CDCC attempted to complete them later. In this way, CDCC's Management was improved. Therefore, ① is judged to have been achieved.

In conclusion, output 5 is judged to have been achieved

6) Output 6 (Extended period): Management of ponds for small-scale shrimp aquaculture is developed.

①A market analysis of small-scale shrimp aquaculture

The international shrimp price was going down after 2000. Therefore, the project analyzed the domestic market for small-scale shrimp aquaculture and discovered that an additional study was required. However, the project continued to develop strategic Penaeus Monodon that grew out within 150 days, weighed 25 g at the time of harvest, and achieved survival rates higher than 55% as well as conversion rates lower than 2.5[11]. Production continued because the analysis highlighted the possibility that CDCC might be able to sell them at domestic markets if it successfully developed large and inexpensive Penaeus Monodon aquaculture. Therefore, ① is judged to have been achieved.

②Selection of a pilot farm from the area of CDCC

The project team visited five small-scale farms located in Mahajanga and then chose one to serve as a pilot farm for the following two reasons. First, the small-scale farm had the most experience because it had the longest history of aquaculture among the five farms. Second, it had idle land available that was located near CDCC, and the project team was able to obtain an agreement with the farm to use the land during a pilot activity. The way to choose a small-scale farm to serve as a pilot farm was reasonable and therefore ② is judged to have been achieved.

③Provision of a technical assistance for the pilot farm located near CDCC

CDCC provided the pilot farm and its three employees with a technical assistance related to aquaculture pond management and bait production. These skills were required to raise Penaeus Monodon larva provide by CDCC until they developed into grow-out Penaeus Monodon. As a result, the pilot farm succeeded in developing strategic Penaeus Monodon that grew out in 112 days, weighed 25.4 g at the time of harvest, and achieved survival rates higher than 97% as well as conversion rates lower than 0.74. Therefore, ③ is judged to have been achieved.

④ Development of manuals and documents related to aquaculture pond management for small-scale shrimp farmers

The project produced manuals and documents related to aquaculture pond management to be used by CDCC counterparts (e.g., “A manual for the preparation of ponds for small-scale shrimp aquaculture”). CDCC managed

[11] Conversion rate is an indicator to measure the efficiency of bait based on the knowledge that certain kilograms of bait are required to grow 1 kilogram of grow-out fish. Smaller amounts are better. Conversion rates lower than 2.5 kilograms imply that less than 2.5 kilograms of bait are required to grow 1 kilogram of grow-out fish.

aquaculture ponds based on the manuals and related documents as planned during the project period. Therefore, ④ is judged to have been achieved.

In conclusion, CDCC provided the pilot farm with a technical assistance to raise Penaeus Monodon larva provided by CDCC until they developed into grow-out Penaeus Monodon. The pilot farm succeeded in developing strategic Penaeus Monodon. Therefore, output 6 is judged to have been achieved.

7） Output 7(Extended period): Feed development for small-scale shrimp aquaculture is improved

①Research on locally-available materials required to produce bait

The project team performed chemical analyses of locally-available materials required to produce bait. As a result, it discovered that materials such as dried shrimps, dried mysidae, dried small fish, fishmeal, rice bran, and flour were good ingredients for bait. In addition, it discovered that yam worked well as a material to ensure that ingredients adhered to each other. Therefore, ① is judged to have been achieved.

②Improvement of CDCC equipment used to produce bait

An improved hammer mill enabled CDCC to produce micronized materials. A new big granulator enabled CDCC to produce 50 kg of bait per day. These improvements were sufficient to develop bait at CDCC. Therefore, ② is judged to have been achieved.

③Development of effective production technology of bait

Based on the use of locally-available materials, the project developed three kinds of bait. The conversion rates ranged between 1.9 and 2.8. All of these rates were lower than the planned conversion rate of 3.0. In addition, the sales prices for bait amounted to $1.07/kg. This price was lower than the $2/kg price for overseas bait, as well as the $1.8/kg break-even price for small-scale shrimp farmers. Therefore, ③ is judged to have been achieved.

④Training on development of bait for small-scale shrimp farmers

The project provided two separate one-day practical trainings for four CDCC staff and seven small-scale shrimp farmers who possessed, respectively, some knowledge of and experience with aquaculture. It also provided two separate two-day practical trainings for three students and six students at Mahajanga

University, respectively, who possessed limited knowledge of and experience with aquaculture. As a result, the knowledge on bait development was disseminated. Therefore, ④ is judged to have been achieved.

⑤Development of manuals and documents related to bait development for small-scale shrimp farmers

The project produced manuals and documents related to bait development to be used by CDCC counterparts (e.g., "A manual on bait production for small-scale shrimp farmers"). CDCC produced bait based on the manuals and related documents as planned during the project period. Therefore, ⑤ is judged to have been achieved.

In conclusion, CDCC succeeded in developing bait that used locally-available materials for small-scale shrimp farmers and disseminated its knowledge. Therefore, output 7 is judged to have been achieved.

8） Output 8 (Extended period): Epidemic disease prevention measures for small-scale aquaculture are improved

①Improvement of epidemic disease prevention at CDCC

The project intended that pathological examination techniques focused on bacterial diseases and epidemic disease prevention techniques that relied on the control of water quality at hatcheries and ponds would be improved. Both of them were realized as planned. CDCC improved epidemic disease prevention measures by letting its counterparts receive training on pathological examination techniques at the Pasteur Institute and developing a manual of diseases and their prevention for Penaeus Monodon. It is considered that such improvements were sufficient, because no epidemic disease occurred when the project completed in 2006. Therefore, ① is judged to have been achieved.

②Training focused on epidemic disease prevention for small-scale shrimp farmers

The project provided a one-day practical training for 25 trainees from MALF, CDCC and small-scale shrimp farmers who possessed some knowledge of and experience with aquaculture. It also provided a one-day practical training for 16 students at Mahajanga University who possessed limited knowledge of and experience with aquaculture. In addition, it provided a presentation on epidemic disease prevention measures in Japan for 75 people drawn from small-scale shrimp farms and Mahajanga University. In so doing, it disseminated knowledge on

epidemic disease prevention. Therefore, ② is judged to have been achieved.

③Development of manuals and documents related to epidemic disease prevention for small-scale shrimp farmers

The project has produced manuals and documents related to epidemic disease prevention to be used by CDCC counterparts (e.g., "A manual on diseases and their prevention for Penaeus Monodon"). CDCC took epidemic disease prevention measures based on the manuals and related documents as planned during the project period. Therefore, ③ is judged to have been achieved.

④ Consideration of introducing a new shrimp with disease resistance for small-scale shrimp farmers

The project considered the introduction of seawater and freshwater shrimps, and selected Macrobrachium a highly disease-resistant freshwater shrimp. When the project completed in 2006, CDCC staff were able to produce 0.1 million Macrobrachium. These production methods were incorporated into "A manual for seed production". Therefore, ④ is judged to have been achieved

In conclusion, CDCC succeeded in improving pathological examination techniques and epidemic disease prevention techniques by controlling water quality at hatcheries and ponds. It also disseminated knowledge on epidemic disease prevention. Therefore, output 8 is judged to have been achieved.

3.2.1.2 Achievement of Project Objectives

Project Objective: CDCC's Technical capabilities to develop aquaculture adjusted to the local environments and conditions are improved

Indicator: Development of Penaeus Monodon that grows out within 150 days, weighs 25 g at the time of harvest, achieves survival rates higher than 55%, and conversion rates lower than 2.5.

The Pilot farm developed Penaeus Monodon that grew out in 112 days, weighed 25.4 g at the time of harvest, and achieved survival rates higher than 97%, and conversion rates lower than 0.74. In addition, CDCC achieved higher than planned production volumes, production rates, and survival rates of Penaeus Monodon, though these rates fell when large-scale companies ceased ordering Penaeus Monodon from CDCC.

In conclusion, this project has largely achieved its objectives.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

Sustainable shrimp aquaculture by small-scale farmers is promoted in the northwest region of Madagascar

1) Indicator 1: The number of small-scale shrimp farms and the areas of aquaculture ponds in the northwest region of Madagascar increase in comparison with those in 2003

Table 4: The number of small-scale shrimp farms and the areas of aquaculture ponds

	2003	2012
Small-scale shrimp farm (household)	5	0
Areas of aquaculture ponds (ha)	41.4	0

Sourced: CDCC

In 2003, five small-scale farms engaged in Penaeus Monodon aquaculture at 41.4 ha of aquaculture ponds in total. However, because of the slump that occurred in international shrimp prices[12], two small-scale farms withdrew from the market in 2004. Additional two farms withdrew from the market in 2007 and the remaining one farm withdrew from the market in 2009. No newcomers entered the market because the project struggled to continue its extension and promotion activities of shrimp aquaculture between 2003 and 2012. As a result, no small-scale shrimp farm and aquaculture ponds were in operation in 2012. Therefore, the overall goal in terms of the indicator 1 has not been achieved.

2) Indicator 2: Economic impacts for small-scale shrimp farms and the region

No small-scale shrimp farm were in operation at the time of the ex-post evaluation in 2013. Therefore, there was no impact for farms. CDCC sold approximately 46 million postlarva Penaeus Monodon in 2011 and 74 million postlarva Penaeus Monodon in 2012 to a large-scale company that exports shrimps. However, because the company was considering the construction of hatcheries for seed production, it is uncertain that the company will continue to place orders for postlarva Penaeus Monodon with CDCC in the future.

As the terminal evaluation of the project in 2003 noted, implementation of an activity to develop a system to provide continuous training for the purpose of promoting small-scale shrimp aquacultures was required to achieve the overall goal. However, this activity was not included in the original Project Design Matrix (PDM). Nor was it included in the PDM created after the mid-term evaluation of the project.

[12] $17.4/kg in 2000 →$11.6/kg in 2003 →$10.4/kg in 2006 →$8.6/kg in 2012

Hence, an extension of the project was required. However, this activity was not included in the PDM in the end and implemented even during the extended period. Therefore, it is difficult to say that outputs were appropriate to achieve the overall goal.

In conclusion, it is true at the time of the ex-post evaluation of the project in 2013 that CDCC sells postlarva Penaeus Monodon to the large-scale company, but it is uncertain as well that it can continue to do so in the future. In addition, the overall goal was not achieved because of the inappropriate setting of outputs. Therefore, it is judged that the overall goal has not been achieved.

3.2.2.2 Other Impacts

①Impacts on the natural environment

None.

②Relocation and land acquisition

None.

③Other indirect impacts

Mahajanga University opened a shrimp aquaculture course of 25 students in 1999 and reopened a general aquaculture course in 2006. Since that time, the university has been using CDCC facilities as its practical teaching facilities.

In conclusion, this project has not achieved its objectives, and therefore its effectiveness is low.

3.3 Efficiency (Rating:①)

3.3.1 Inputs

Table 5: Planned and actual performance of inputs

	Plan	Actual performance
Japanese side		
Project cost	680 million yen	917.1 million yen (Original period: 813.15 million yen, Extended period: 103.95million yen)
Project period	April, 1998 – March, 2003 (60 months)	April 1998 – May 2006 (98 months) (Original period: April 1998 – March 2003, Extended period: December 2003 – May 2006)
Experts	Long-term: 4 experts Short-term: N/A	Long-term: 7 experts (Original period: 6, Extended period: 1) Short-term: 18 experts (Original period: 14, Extended period: 4)
Trainees received	5 – 10 trainees	11 trainees (Original period: 11, Extended period: 0)
Third Country Training	None	None

Program		
Equipment	N/A	128.38 million yen (Original period: 117.13 million yen, Extended period: 11.25 million yen)
Local cost	N/A	103 million yen (Original period: 89 million yen, Extended period: 14 million yen)
Madagascar side		
Counterparts	N/A	17 counterparts (Original period: 8, Extended period: 9)
Land, Facilities, and Equipment	Office, tables, chairs, etc	Office, tables, chairs, etc
Local cost	N/A	75 million yen (Original period: 53 million yen, Extended period; 22 million yen)

Source: CDCC

3.3.1.1 Elements of Inputs

＜Japanese side＞

The achievement level for output 4 during the original project period was not high enough to realize the overall goal. Therefore, it was necessary to extend the project period to carry out output 6 through 8 to strengthen the achievement level for output 4. As a result, the actual project cost exceeded the planned project cost. The actual project period also exceeded the planned project period due to the same reason. The number of long-term experts dispatched from Japan exceeded the planned number because two long-term experts in charge of project coordination and aquaculture had to be replaced. The number of trainees sent to Japan also exceeded the planned number because new staff required training for reasons such as counterparts' retirement. It was not possible to compare actual figures with planned figures of others because of the limited information available at the time of the project's planning.

＜Madagascar side＞

The provision of land, facilities, and equipment was achieved as planned. It was not possible to compare actual figures with planned figures of others because of the limited information available at the time of the project's planning.

3.3.1.2 Project Cost

While the planned project cost was 680 million yen, the actual project cost was 917.1 million yen (135% increase of the plan) and therefore higher than planned. It was because of an increase in the number of long-term experts and the extension of the project period.

3.3.1.3 Period of Cooperation

While the planned project period was 60 months, the actual project period was 98 months (163% increase of the plan) and therefore significantly higher than planned. It was because the achievement level of output 4 during the original project period was not high enough to realize the overall goal, and it was necessary to extend the project period in order to carry out output 6 through 8 to strengthen the achievement level of output 4.

Project cost exceeded the plan and project period significantly exceeded the plan, and therefore efficiency of the project is low.

3.4 Sustainability (Rating:①)

3.4.1 Related Policy towards the Project

The Madagascar Action Plan (2006) and the Master Pan on Aquaculture (2003) remain unchanged. However, MALF supervising CDCC is not actively considering the promotion of small-scale shrimp aquaculture because of the slump that occurred in the international shrimp prices at the time of the ex-post evaluation study of the project in 2013. Thus, the importance of the project on small-scale shrimp aquaculture appears to have decreased. Therefore, it is judged that sustainability in terms of policies after the project is low.

3.4.2 Institutional and Operational Aspects of the Implementing Agency

Based on a decision made by the government of Madagascar in October, 2012, the legal status of CDCC changed from an Establishment of Public Administration (EPA) to an Establishment of Public Industry and Commerce (EPIC) that involves independent accounting systems. It was not realistic to expect that CDCC would earn sufficient sales revenues from shrimp aquaculture in the middle of a major decline in international shrimp prices. Consequently, CDCC was restructured from the entity to produce only shrimp into the entity to produce other kinds of fish as well as shrimp, the Center of Development of Aquaculture (CDA).

CDA currently employs 29 staff members. This include one CDA director, three accountants, one human resource officer, one secretary, one officer in charge of seed production, one officer in charge of pond management, four technicians, five assistant technicians, and twelve other staff including drivers and security staff[13]. The total

[13] While the CDA director is a national government officer, the remaining staff are employed by CDA.

number of staff employed is smaller than planned, but the number of core staff of fifteen in charge of operations and maintenance related to the project (i.e., one CDA director, three accountants, two officers in charge of seed production and pond management, four technicians and five assistant technicians), is slightly larger than the planned number of fourteen. However, because no biologist who can handle epidemic disease prevention measures has been employed, it is difficult to say that there is no problem with institutional and operational aspects of CDA.

3.4.3 Technical Aspects of the Implementing Agency

The CDA director was the counterpart in charge of pond management and can manage ponds together with the current officer in charge of pond management. Therefore, there is no problem with pond management. The current officer in charge of seed production was the counterpart in charge of seed production and can continue to produce seed for the large-scale company even after the project. Therefore, there is no problem with seed production. However, a manual on epidemic disease prevention is not in use and vacant positions for biologists have not been filled. Therefore, epidemic disease prevention measures, including pathological examinations and control of water quality, are not fully functional. Diseased fish have not been found at CDA. However, fish infected with white spot disease[14] have been found at a large-scale company near CDA. Hence, there is a concern about infections. Currently, therefore, it is difficult to maintain the project objective that CDCC's technical capabilities to develop aquaculture adjusted to the local environments and conditions are improved. This objective was once achieved at the time of the project's completion in 2006. It is also still difficult to achieve the overall goal that sustainable shrimp aquaculture by small-scale farmers is promoted in the northwest region of Madagascar because a system to provide continuous training has not been developed yet.

[14] If fish become infected, they develop functional problems with their gills and suffocate.

3.4.4 Financial Aspects of the Implementing Agency

Table 6: P/L of CDCC (CDA)

(Unit: MGA Million)

		2010	2011	2012
Revenue	Govt. budget (AMPA)	115	120	120
	Sales (shrimp)	20	182	294
	Total	135	302	414
Expense	Human resources	76	97	102
	Operation	98	102	134
	Maintenance	13	9	15
	Others	17	9	10
	Total	204	217	261
Net		-68	84	153

Source: CDCC

The MALF relies on funds provided by the Madagascar Agency of Fisheries and Aquaculture (AMPA[15]). It allocates budget to CDCC (CDA). Over the past three years, the government budget remained stable. However, because the government budget was not enough to cover annual expenses of CDCC (CDA), sales revenues must increase. Sales revenues in 2010 were so low that the net was minus MGA 68 million. However, sales revenues in 2011 and 2012 increased significantly because of orders from the large-scale company. This resulted in a positive net of MGA 84 million and MGA 153 million, respectively. However, because the large-scale company is considering the construction of hatcheries for seed production, it is uncertain that the company will continue to place orders with CDCC (CDA) in the future. Therefore, one cannot deny the possibility that the net may become negative again. Besides, CDCC (CDA) has not developed a mid- to long-term management plan to stabilize its shaky financial situations. Therefore, it is difficult to say that there is no problem with financial aspects of CDCC (CDA).

In conclusion, major problems have been observed in the policy background and concerns have been also found in the structural, technical, and financial aspects of CDCC (CDA), and therefore sustainability of the project effects is low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project intended to develop shrimp aquaculture technologies at CDCC for the purpose of promoting the growth of small-scale Penaeus Monodon aquacultures. The

15 Development Fund for Marine Resources and Agriculture (FDHA) of MALF was restructured into Madagascar Agency of Fisheries and Aquaculture (AMPA) in 2006.

objective of the project was in line with the development policies of Madagascar and Japan, as well as with the development needs of Madagascar at the time of the project's planning. However, it was not partially in line with the development needs at the time of the project's completion. Therefore, relevance is fair. The project improved CDCC's technical capabilities and successfully developed shrimp aquaculture technologies for small-scale farmers. However, because of a slump that occurred in international shrimp prices, all small-scale farmers withdrew from the shrimp market. In addition, both the project and the government of Madagascar struggled to continue the extension and promotion of shrimp aquaculture activities, no small-scale farmers entering the market. Consequently, no small-scale farmers are engaged in aquaculture activity. Therefore, none of the project's intended impacts was realized. Project cost exceeded the planed costs. The project period significantly exceeded the planned project period. Therefore, efficiency is low. The government of Madagascar still faces difficulties in extending or promoting small-scale shrimp aquaculture activities due to the slump of the international shrimp prices. In addition, these activities are not well-supported by other policies. Therefore, sustainability of the project effects is low.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

CDA needs to reconsider its objectives and roles in small-scale shrimp aquaculture.

CDA, Establishment of Public Industry and Commerce (EPIC), needs to maintain independent accounting systems, but whether or not CDA can maintain it heavily depends on orders from the large-company. Therefore, CDA needs to make a mid- to long-term management plan that enables CDA to maintain independent accounting systems, including diversifications of sales revenues, based on its objectives and roles in small-scale shrimp aquaculture.

4.2.2 Recommendations to JICA

Although MALF has directed CDA to make a mid- to long-term management plan and Japan International Cooperation Agency (JICA) has been in consultation with CDA in this matter, CDA has not made it yet. JICA should keep its consultation with CDA and monitor CDA's progresses in making it.

4.3 Lessons Learned

International shrimp prices increased at the time of the project's planning, and therefore the project intended to promote Penaeus Monodon aquaculture for the international

market. However, there is no record of international market analyses at the time of the project's planning. In addition, despite the fact that the international shrimp prices were declining at the time of considering whether or not the project should be continued, the project continued without analyzing international market. When the project performed a domestic market analysis during the extended project period, the analysis concluded that additional study was required. However, the project continued based on the possibility noted by the analysis that CDCC (CDA) might be able to sell Penaeus Monodon at domestic markets if it successfully developed large and inexpensive aquaculture. However, because of the continuous decline in international shrimp prices, small-scale shrimp farms lost their incentive to engage in Penaeus Monodon aquaculture. As a result, existing small-scale farms started withdrawing from the market during the project period and there was no small-scale shrimp farm in the end.

Therefore, when a technical assistance project supports the production of an agricultural product that is susceptible to international market prices and aims to increase its promotion, it is important to carry out in-depth market analyses and fully consider both the feasibilities and risks involved in the production and promotion of the agricultural product. Should the analyses reveal that it is difficult to foresee market trends, it is important to consider changes to the project design (e.g., choosing an agricultural product that is less susceptible to international market prices) or even consider cancelling the project per se. Should the analyses were able to foresee market trends but international market prices unexpectedly declined contrary to the analyses, it is important to carry out additional in-depth market analyses and consider changes to the project design (e.g., changing some outputs, project objectives, or impacts) or even consider cancelling the project per se.