

## Ex-Post Monitoring of Completed ODA Loan Project

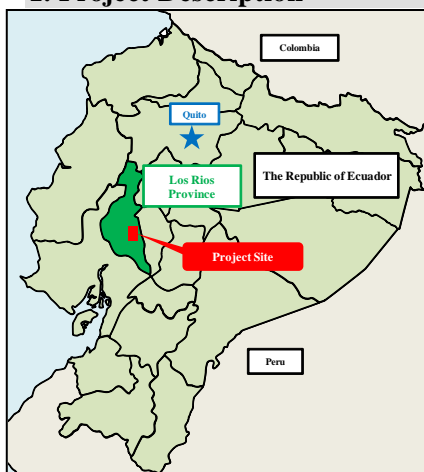
The Republic of Ecuador

Catarama River Basin Irrigation Project

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### 1. Project Description



Project Location Map



Top: Sibimbe Head Works / Bottom: Main Irrigation Channel in Sibimbe Area

#### 1.1 Project Objective

The objective of this project is to increase agricultural production and improve agricultural productivity by building irrigation and drainage facilities in Ecuador's coastal region of the Catarama River Basin, thereby contributing to the betterment of farmers' livelihood, and encourage economic development in the region.

#### 1.2 Outlines of the Loan Agreement

Approved Amount / Disbursed Amount	8,594 million yen / 7,320 million yen
Loan Agreement Signing Date / Final Disbursement	February, 1988 / February, 2003
Ex-post Evaluation	2005
Executing Agency	Comisión de Estudios para el Desarrollo de la Cuenca del Río Guayas (CEDEGE)
Main Contractor	Hidalgo & Hidalgo S.A (Ecuador)
Main Consultant	Nippon Koei Co., Ltd.

#### 1.3 Background of Ex-post Monitoring

While Ecuador is an oil-producing nation and its economy is largely dependent on crude oil

production, its agricultural sector also plays a major economic role, and accounts for approximately 46% of the nation's workforce. Increasing agricultural productivity was a challenge for Ecuador's agricultural sector, and its undeveloped irrigation system was given as one of the reasons. In particular, concentrated efforts were made to develop the coastal region of Costa as an agricultural zone, but on account of its undeveloped irrigation system, water shortages during the dry season and flood damage during the rainy season were major factors in hampering the region's agricultural productivity increase. In light of such circumstances, the Government of Ecuador made the development of the nation's irrigation sector the focus of the four-year national development plan established in 1985, in which five large-scale irrigation projects were planned. The Catarama River Basin was included in one of the 10 plans constituting the irrigation plan for the lower Guayas River Basin, an area suitable for the cultivation of agricultural produce (Lower Guayas River Basin Irrigation Plan). This project was designed to improve poor drainage and improve agricultural productivity by developing an irrigation system in the Catarama River Basin.

At the time of ex-post evaluation in 2005, the area of cultivation did not reach the planned value and the project did not produce much from the viewpoints of effectiveness and impact. This is because the relation between benefits and burdens by implementation of the irrigation project was not understood well. In addition, support systems such as agricultural management guidance to support the effective use of the irrigation system were not well developed. Therefore, it was expected to conduct educational activities and establish a loan system to promote the use of the irrigation facilities.

Therefore, this project was selected for ex-post monitoring and reviewed under each criterion with the findings from the field survey and other research activities with a final conclusion being drawn.

## **2. Outlines of the Monitoring Study**

### **2.1 Duration of Monitoring Study**

Duration of the Study: March 2011 – October 2011

Duration of the Field Survey: Not conducted

### **2.2 Constraints during the Monitoring Study**

Since study in the irrigation project had already been conducted by an expert by January 2011, this monitoring was conducted by analysis without any field survey. Internal documents with the latest information were used as reference for analysis to develop this report.

### 3. Monitoring Results

#### 3.1 Effectiveness

##### 3.1.1 Quantitative Effects

###### (1) Results from Operation and Effect Indicators

The effects brought by the Project after the ex-post evaluation were analyzed by the operational effect indexes such as area of cultivation, production volume and yield per unit.

###### 1) Area of Cultivation

As shown in Fig. 1, the area of cultivation increased from 5,329ha at the time of the ex-post evaluation (2004) to 6,010ha (2008), however, it did not reach the planned value of 9,002ha. What were greatly increased after the ex-post evaluation were cultivation areas of African palms of 150ha (no report in 2004) and rice of 3,700ha (3,000ha in 2004).

Rice makes up a large portion of the area of cultivation and its production volume is large, while the yield per unit is not particularly high. On the other hand, the area of cultivation of bananas and African palms is smaller but the yield per unit is higher: especially, the production volume of bananas is greater than that of rice.

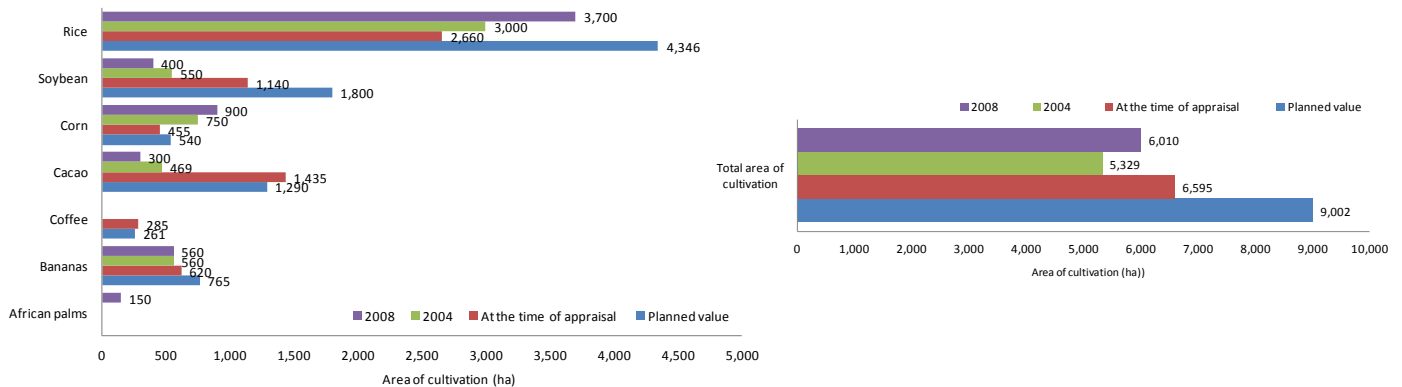


Fig. 1 Area of Cultivation (by crop and total area)

###### 2) Production Volume

As shown in Fig. 2, the production volume of corn was greatly increased to 3,600t from 800t in 2004. This is considered to have resulted from introduction of new varieties, in comparison to an increase of the area of cultivation.

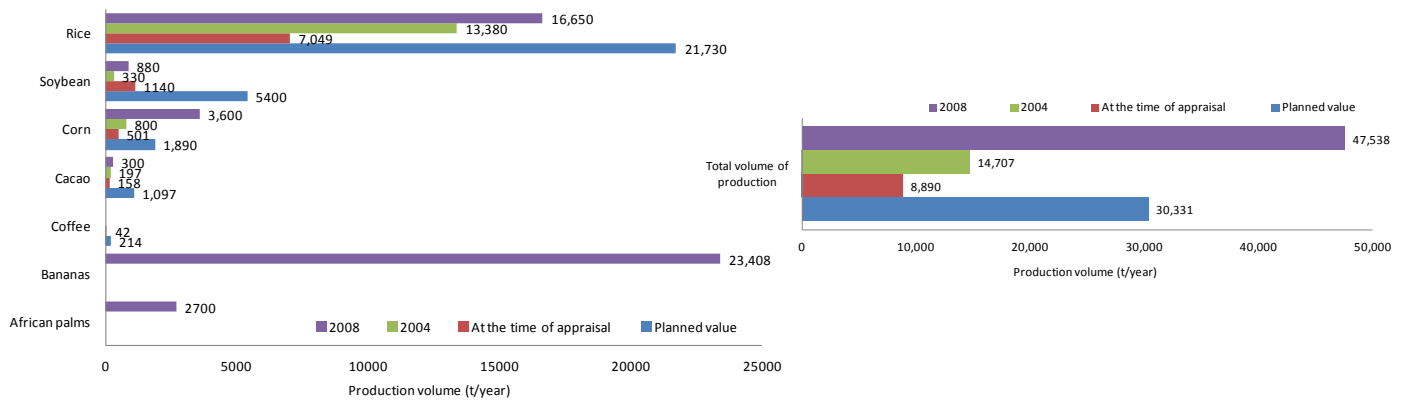


Fig. 2 Production Volume (by crop and total area)

### 3) Yield per Unit

As shown in Fig. 3, the yield per unit of cacao was increased to 1.0t/ha from 0.4t/ha in 2004. This is considered to have resulted from progress of change to a new hybrid variety CCN51.

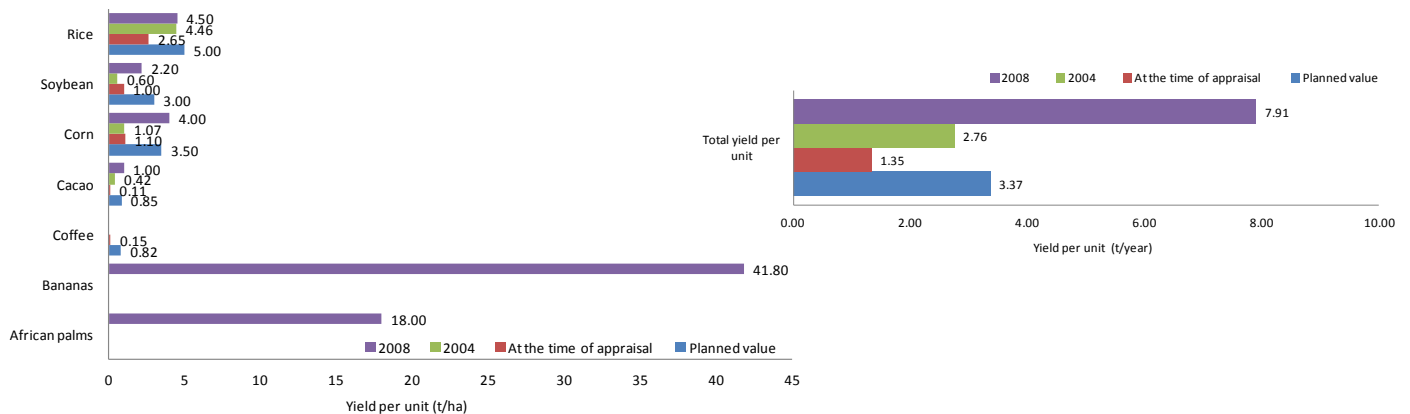


Fig. 3 Yield per Unit (by crop and total area)

Regarding the agricultural productivity, the average yield of rice is 4.0t/ha in the area (Los Rios Province, Agricultural Census, 2000), while it is a little higher, being 4.5t/ha (see Fig. 3, 2008) in the project area. The comparison of 2004 and 2008 for the area of cultivation (see Fig. 1) and the production volume (see Fig. 2) shows that the production volume increased in tandem with increase of the area of cultivation. Increase of the production volume is considered to have resulted from increase of the area of cultivation by irrigation, because it was not stated that new varieties had been introduced in the internal documents.

### (2) Results of Calculations of Internal Rates of Return (IRR)

Neither the Financial Internal Rate of Return (FIRR) nor Economic Internal Rate of Return (EIRR) was calculated, because there were no data available.

### 3.1.2 Qualitative Effects

At the time of the ex-post evaluation, the drainage canals and embankments in the lower basin had been planned to be constructed at the expense of the Ecuador Government and they were expected to prevent the damage of 1,160ha out of 2,680ha of flood-prone area during the rainy season. However, it seems that the possibility of floods still remained for approximately 1,520ha in the lowest basin because the Ecuador Government did not construct a drainage pump station.

Regarding progress of construction, according to the internal documents, land expropriation and ground preparation of the construction site had been finished but construction has not been started as of January 2011.

The flood damage, especially the flood conditions of the lowest basin in relation to the drainage conditions, had been examined as of March 2009. According to the internal documents, the “Documentation about Drainage in Southern Part of Catarama Irrigation Project (December 1999)” states

that, of approximately 1,520ha in the lowest basin, 330ha would become uncultivable and 20ha would be affected in Sibimbe I Area; 250ha would become uncultivable and 285ha would be affected in Sibimbe II Area; and 635ha would be affected in Catarama Area. It means that a total of 1,520ha would be affected by floods in some way.

Table 1 Flood Area during Rainy Season

Crop Name		Flood Area			
		Sibimbe I (2,350ha)	Sibimbe II (1,380ha)	Catarama (2,030ha)	Total
Annual crop	Rice	330	250	360	940
Perennial crop	Bananas	-	105	-	105
	Cacao	20	50	150	220
	Coffee	-	120	120	240
	Pasture	-	10	5	15
Total		350	535	635	1,520

In conclusion, in terms of effectiveness, the agricultural productivity has been improved by execution of the irrigation project, while the flood countermeasures have merely remained as a plan.

## 3.2 Impact

### 3.2.1 Intended Impacts

“Improvement of agricultural incomes” is considered as an impact of the project concerned. The ex-post evaluation reported that a positive effect was not necessarily seen, because a certain increase in incomes

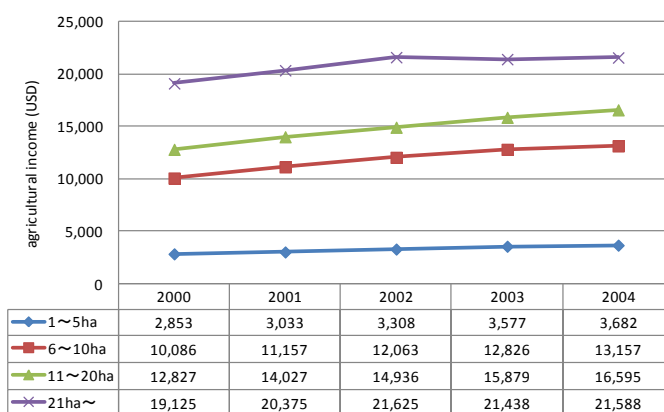


Fig. 4 Changes in Farmers' Incomes by Cultivation Area

since 2000 was observed but there was no big change in virtual incomes in consideration of the inflation rate<sup>1</sup>.

The internal documents report changes in agricultural incomes as shown in Table 2. The incomes of landowner farmers are regarded as US\$800 – 1,000 per month. Compared with the farmers’ incomes by cultivation area (US\$307 – 1,799/month)<sup>2</sup> as shown in Fig.4, it is assumed that the incomes of farmers with a relatively small cultivation area (10ha or less) are on the increase, while those of farmers with a larger cultivation area are either constant or on the decrease. Such increase is considered to have been partly

Table 2 Farm Economy & Living Conditions

	Landowner Farmers	Non-Landowner Farmers
<b>Living conditions</b>	<ul style="list-style-type: none"> <li>• Living in urban areas</li> <li>• Small and medium-sized farming with an average farm field of 4.5ha (76% of the farmers have fields of 5ha or less)</li> </ul>	<ul style="list-style-type: none"> <li>• Living in villages</li> <li>• Living as peasants on the rented farm fields without owning sufficient land and also engaged in farming as day agriculture workers</li> </ul>
<b>Economic conditions</b>	<ul style="list-style-type: none"> <li>• They do not necessarily run large-scale plantations and their average income is said to be about US\$800 – 1,000.</li> </ul>	<ul style="list-style-type: none"> <li>• In the case of day workers, as their daily wage is US\$10, they are supposed to earn US\$200 – 300 per month if they work 20 – 30 days per month.</li> <li>• As the monthly income of the workers in cities is US\$480, that of the day agriculture workers is lower than that. Their incomes are not stable because</li> <li>• there may be no employment during agricultural off-seasons.</li> </ul>

Table 3 Profitability of Crops

Item	Investment per hectare (Investment/ha)	Profit per hectare (Profit/ha)	Profit/Investment	
Rice	1,777.00 US\$	2,019.60 US\$	1.14	
Soybean	550.4 US\$	62.55 US\$	1.75	
Corn	1,465.74 US\$	1,950.80 US\$	1.33	
Cacao	1,580.20 US\$	2,340.00 US\$	1.48	
Bananas	1st year	30,432.00 US\$	25,530 US\$	0.83
	2nd year	9,237.00 US\$	25,530 US\$	2.76
African palms	1,024.00 US\$	2,326.10 US\$	1.27	

due to the higher profitability of crops as shown in Table 3 and higher production volume of profitable bananas as shown in Fig. 2.

On the other hand, the incomes of non- landowner farmers are lower than that of laborers in town, in consideration of the employment situations in agricultural off-seasons. Compared to the agricultural land holders (landowner farmers), it cannot be necessarily said that the agricultural income of the non-landowner farmers has improved due to irrigation.

### 3.2.2 Other Impacts

Regarding relocation of residents and land acquisition, there were problems such as non-approval of budget for land acquisition due to the financial situation of Comision de Estudios para el Desarrollo de la Cuenca del Rio Guayas (hereinafter referred to as CEDEGE) at the time of the ex-post evaluation.

<sup>1</sup> According to the “Key Economic Indicators of Ecuador, revised in 2009” (May 2009, Ministry of Foreign Affairs, Embassy of Japan in Ecuador), the inflation rate in Ecuador was increasing between 1.6% and 2.9% from 2001 to 2004, between 2.7% and 3.4% from 2004 to 2007, and stood as high as 8.8% in 2008, but it did not become a factor to dramatically increase incomes.

<sup>2</sup> In Fig. 4, 1 – 5ha is US\$3,682/year. Thus, US\$3,682/12 months = US\$307/month. In the same manner, 6 – 10ha gives US\$1,096/month, 11 – 20ha US\$1,383/month, and 21ha or more US\$1,799/month.

According to the internal documents, budgets were allocated to the labor costs, to a small portion of the facility costs and to maintenance costs. The difficult situation to secure financial resources for land acquisition had not changed since the time of the ex-post evaluation and the land acquisition expenses would not be approved. Therefore, problems arose concerning outstanding payments for land taken over to construct the facilities, and there has been no progress in payments for over one and a half years since June 2007. 165 people have not been paid yet and the total amount of outstanding payments is approximately US\$110,000. It will be difficult to reduce or dispel residents' distrust of this irrigation project unless this issue is solved. As mentioned below, according to the internal documents, while the responsibility of the local government (Los Rios Province) for the irrigation project has become greater, and the local budget is deemed to increase in the future, it was not clear if the financial resources for land acquisition have been secured.

The conclusion is that the living and economic situations of the non- landowner farmers could not be necessarily said to have been improved, while the living and economic situations of the agricultural landholders (landowner farmers) were improved as the profitability of crops increased.

### **3.3 Sustainability**

#### **3.3.1 Structural Aspects of Operation and Maintenance**

##### **(1) Executing Agency**

CEDEGE, the executing agency at the time of the ex-post evaluation, experienced an organizational change by the time of the monitoring study as shown in Table 4. The systems and situations of each organization are as summarized in Table 4.

Table 4 Executing Agency Change

	<b>CEDEGE ( At the time of ex-post evaluation in 2005 )</b>	<b>CEDEGE→INAR ( 2009 )</b>	<b>MAGAP(INAR)+Los Rios Province ( 2011 )</b>
<b>Systems &amp; Situations</b>	<p>The number of employees is 134 and 6 people are assigned to the project (3 agricultural engineers and 3 other engineering staff). Since CEDEGE is basically aimed at development of water resources, it is necessary to strengthen cooperation with other organizations for intangible support such as agricultural management guidance. In the future, to ensure the effects from the project, it is necessary to strengthen cooperation with the relevant government agencies such as Ministerio de Agricultura, Ganaderia, Acuicultura y Pesca and El Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP) and improve the support system. The day-to-day operation and maintenance of the irrigation facilities were conducted by Hidalgo &amp; Hidalgo Corporation but it was transferred to CEDEGE in December 2005, and after that, self-management of the facilities by an irrigation association is planned.</p>	<ul style="list-style-type: none"> <li>·The number of employees is 230 and 113 out of 230 are regular employees, and 117 are on contracts. 69 are engineers or technicians.</li> <li>·The Maintenance and Production Development Department is in charge of the project after completion of construction works.</li> <li>·Ventanas Office, which is in charge of this project organizationally belongs to Irrigation, Drainage and Flood Management Department. It has 10 staff.</li> <li>·Ventanas Office is in charge of maintenance of this project. Its main tasks are collection of the usage fees of this project and maintenance, while it also works on facilitation of the procedures of land expropriation and promotion of utilization of irrigation facilities on a trial basis.</li> <li>·INAR was founded by the presidential decree dated November 12, 2007. INAR is responsible for promotion of irrigation infrastructure aimed at small and medium-sized farmers and operation of irrigation projects and supervision of public administration of sustainable natural resources. This places INAR in a position to take over all irrigation projects in Ecuador and this project was taken over by INAR from CEDEGE.</li> </ul>	<ul style="list-style-type: none"> <li>·INAR was integrated into MAGAP on December 14, 2010. However, the current organization is expected to be maintained for the time being.</li> <li>·In line with the new constitution, regarding division of the roles for irrigation development between MAGAP after integration of INAR and local governments, it was decided to give more roles to the local government (Los Rios Province).</li> <li>·In response to increase of the roles for provincial economic development by the new constitution, Los Rios Province established the Bureau of Economic Development. The bureau has 60 staff (41 out of 60 are in charge of agricultural development), comprising a Production Enhancement Department and an Agricultural Development Department; The Agricultural Development Department is mainly responsible for agricultural development.</li> </ul>

As described in Table 4, the agency in charge of operation and maintenance has changed from CEDEGE to Instituto Nacional de Riego (hereinafter referred to as INAR) and then to Ministerio de Agricultura, Ganaderia, Acuicultura y Pesca (hereinafter referred to as MAGAP) in a short period of time since 2005. Consequently, the maintenance system is not



consistent and the contents of maintenance, role sharing and personnel structure are not clear.

As the roles/responsibilities of the local government (Los Rios Province) have been recently increased based on the new constitution, it is considered that cooperation between the agencies of the central government (INAR and MAGAP) and the local government (Los Rios Province) will become more important. However, division of the roles is not clear and measures overlap between the central and provincial governments: for instance, support for community and irrigation association are listed as measures taken by the central and local governments respectively. It may be necessary to pay attention to the situation of unclear division of the roles, which may cause negative effects such as delay of implementation of measures.

As it stands now, maintenance is taken care of by INAR and has not been transferred to Junta General de Usuarios de Canal en Catarama Sibimbe (hereinafter referred to as JGU).

## (2) Irrigation Association

The situations of the irrigation association are summarized in the table below.

Table 5 Change of Irrigation Association

	<b>Irrigation Association (At the time of ex-post evaluation in 2005)</b>	<b>Junta General de Usuarios de Canal en Catarama Sibimbe (JGU) ( 2011 )</b>
<b>Systems &amp; Situations</b>	An irrigation association per irrigation project should be established under the Water Act (Ley de Agua). An association has been already established and the association rules have been developed for this project. The organizational structure is to divide the canal into 11 areas and assign 3 representatives per area (1 head and 2 deputy heads), consisting of 34 representatives in total including the association representative. However, there was no actual activity performed and it was observed that some farmers had little intention to participate in maintenance.	<ul style="list-style-type: none"> <li>• The committee consists of 125 registered members, which is a much smaller membership than the expected membership of 518 when the irrigation project was planned.</li> <li>• In 2010, an election was held at the committee to select a new head. The organization is being restructured in accordance with the road map (Basic Study Procedures for Catarama River Irrigation Project Vitalization) developed by INAR and it is planned to update the organizational rules, etc.</li> </ul>

According to the internal documents, the responsibility for maintenance is planned to be transferred to JGU. An election to select the chief representative will be held at the committee and the rules will be reviewed and updated. It is judged from such situations that the environment is being improved to carry out maintenance activities systematically.

However, because the membership is small and the human resources to carry out activities are insufficient, and also because profitability may not be enough due to the small membership, it is considered that there still remain some issues to be solved for practical activities.

### **3.3.2 Technical Aspects of Operation and Maintenance**

As stated in 3.3.1, at the time of January 2011, MAGAP (INAR) and Los Rios Province took care of maintenance, not CEDEGE. Therefore, the outlines of MAGAP (INAR), Los Rios Province (Bureau of Economic Development) and JGU are hereinafter described.

#### **(1) MAGAP (INAR)**

According to the internal documents, INAR had 370 employees in March 2009 and 86 out of 370 worked at the head office, however, the number of engineers/technicians had not been figured out.

This project is under the jurisdiction of INAR Guayas River Basin Office. The number of staff of the office was 17 in March 2009; 2 agricultural civil engineers, 1 agricultural engineer, some others specialized in marketing and environment, lawyers, etc. Not only its organization but also their staffs are not fully prepared for operation because this office was newly established.

At this time, INAR seems to function as a part of MAGAP but there is no information such as the number of specialists to figure out its engineering level.

#### **(2) Los Rios Province (Bureau of Economic Development)**

According to the internal documents, the bureau had 41 agriculture-related specialists. Their main areas of expertise are; agriculture (14 persons), veterinary (7 persons), social development (4 persons), organic agriculture (1 person), agricultural economy (1 person), commercial (1 person), etc.

#### **(3) JGU**

According to the internal documents, the committee played almost no role under the situation that utilization of the irrigation facilities was not used to the full.

In conclusion, while agriculture-related specialists and engineers are assigned to MAGAP (INAR) and Los Rios Province (Bureau of Economic Development), it is unclear how engineering and specialist issues are handled by each organization, because the executing agencies were changed in a short period.

JGU has had almost no role and the operation and maintenance tasks have not been transferred yet, but will be transferred to them in the future as mentioned above.

### **3.3.3 Financial Aspects of Operation and Maintenance**

The financial situations of MAGAP (INAR), Los Rios Province (Bureau of Economic Development) and JGU for operation and maintenance are as summarized below:

(1) MAGAP (INAR)

According to the internal documents, the budget for operation and maintenance of the project was US\$424,320. INAR forecasts that the expenses necessary for operation and maintenance after 2011 will be US\$829,057 per year.

(2) Los Rios Province (Bureau of Economic Development)

According to the internal documents, the provincial budget was increasing every year and the budget for 2010 was US\$29,886,260. The budget for production sectors including the agricultural sector has been allocated in earnest since 2009; it was US\$1,590,000 in 2010. In 2010, the agriculture-related budget was further increased; US\$3,000,000 was allocated for irrigation and US\$2,500,000 for production.

(3) JGU

According to the internal documents, the committee was originally established as an organization to collect the usage fees of irrigation water and take responsibility for future operation and maintenance including facility maintenance and cleaning. In practice, the committee had almost no activity because CEDEGE was in charge of operation, maintenance and fee collection (as of 2009). Regarding the budget, the committee had neither budgets nor assets because it had no external financial resources such as subsidies and it was not in a position to collect the fees.

Regarding the usage fees for irrigation water, the contribution related to the use of irrigation water was said to be US\$80 ha/year at the time of planning. However, it was decided to be US\$3.52 ha/month through discussion between the users and CEDEGE. It means that the amount of contribution fee is only for the volume of used water on a monthly basis. There is no particular penalty, etc. to the delinquents. Thus, stable collection of usage fees is not ensured.

Regarding the financial situations of the execution agencies, as the operation and management were transferred to MAGAP (INAR) and Los Rios Province from CEDEGE, the financial discretion for operation is expected to be improved. However, actual budget allocation is still unclear because division of the operational roles between the central and provincial governments is not clear.

JGU does not perform activities as an irrigation association in the way as mentioned above, however, since the operation and maintenance may be transferred to JGU in the future, it will be important for them to gain the knowledge about finance, charging systems, and fee collection.

### 3.3.4 Current Status of Operation and Maintenance

The internal documents report the operation and maintenance conditions of the following facilities:

#### (1) Drainage

There is little margin between the culvert height and the water height and the garbage flowing down from the upper stream tends to pile up. This could cause flooding and the entire culvert could be under water at the time of flood, making some places impassable.

#### (2) Catarama Pump Station

The operating hours of the pump station, which is the main facility in the Catarama Area, are limited due to operation panel trouble, causing damage such as totally destroying rice which was planted as a dry-season crop. There are also other problems; for instance, the big figures in the upstream areas exclusively exploit the scarce irrigation water.

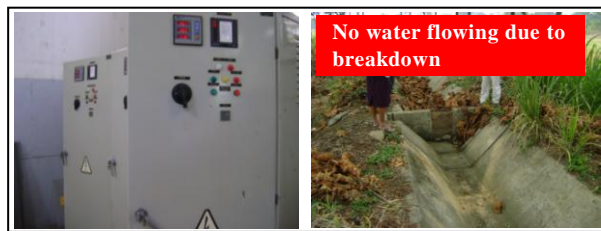


Photo 1 Switchboard (broken down) and Tertiary Channel

#### (3) Flap Gate

The farmers are not happy with the flap gate because it does not serve its designed function at the time of floods.

This happens because a lot of dried grass is tangled in the flap gate and causes the trouble that the gate cannot be closed. The daily maintenance of the main facilities such as the flap gate is particularly important.



Photo 2 Flap Gate

According to the internal documents, Hidalgo & Hidalgo Corporation who constructed the works was in charge of maintenance of the facilities for a while after completion of the works (December 2002). However, the maintenance agency was changed from Hidalgo & Hidalgo Corporation to CEDEGE in June 2005, having Ventanas Office be responsible for all maintenance tasks. After that, the responsibility was moved from CEDEGE to MAGAP (INAR), but there is no change in the situation that the executing agency performs the operation and maintenance. According to the internal documents, INAR Ventanas Office (under the jurisdiction of INAR Guayas Regional Office) performs the operation and

maintenance.

Problems about the maintenance include floods caused by clogged garbage, pump station trouble and flap gate trouble. These problems can be solved or reduced by appropriate daily maintenance. It is judged from these situations that the day-to-day maintenance may be inadequate.

In conclusion, regarding sustainability, it is unclear if adequate systems and sufficient budgets for operation and maintenance are secured, due to consolidation of the executing agencies after 2005.

### **3.4 Others**

At the time of the ex-post evaluation, it was pointed out that the relation between benefits (increase in agricultural production) and burdens (provision of land due to development of fringe farmland and water fees etc.) was not understood well. It was also pointed out that intangible support such as agricultural management guidance to promote the effective use of the irrigation project has not been developed. These were seen as the causes of little progress of the development of fringe farmlands and the use of the irrigation facilities. The following points were suggested as follow-up activities: (1) promotion and establishment of the effects of the irrigation facilities and (2) improvement of comprehensive agricultural development. The results of monitoring about them are described below.

#### **(1) Promotion and Establishment of Effects of Irrigation Facilities**

Regarding educational activities about promotion of the use of the irrigation facilities, according to the internal documents, CEDEGE provided farmers education and irrigation agriculture guidance as described below, however, it did not lead to bringing-out of self-motivated activities by farmers.

##### **1) Farmers Education**

Until mid-2008 the problem often happened that farmers broke part of the concrete wall to take the water into their dry fields without permission because construction of tertiary canals did not make progress. In response to that, CEDEGE performed educational activities, for instance, they toured the regional groups to teach how to use the irrigation water without breaking the concrete wall of the canals. Owing to this, breaking of the irrigation canals has never happened again afterward. However, the instructions for the use of irrigation



Photo 3 Direct Water Intake

water does not include a clear calculation method about the amount of water used which serves as the base for collection of charges from the farmers. Thus there is no way to check the failure to declare the amount of water used by the users.

## 2) Irrigation Agriculture Guidance

CEDEGE established a demonstration farm field for one year in 2007 and provided guidance to the farmers for effective use of the irrigation water to improve productivity. Stevia, corn, cacao, balsa wood, etc. were experimentally grown in the demonstration farm field under contract between CEDEGE and two agricultural chemical companies but the project was discontinued in 2008 due to a budget problem.

What can be assumed as the reason why the educational activities were not so actively promoted is that the agencies in charge of operation and maintenance frequently changed after 2005, and consistent measures could not be implemented in a responsible manner. Moreover, since this irrigation project has not been completed yet to achieve the original target, the focus has been placed on infrastructure improvement to fulfill the plan; for instance, additional construction/improvement of the facilities (tertiary canal and farm field improvement). The situation would not allow to execute intangible measures such as educational activities due to the budget and implementation constraints.

Although there is no self-motivated activity by the farmers, it can be said that the farmers may gradually get involved in utilization promotion and operation of the irrigation facilities, based on the information that an election will be held at JGU, that the organization will be restructured and that there is willingness to be involved in management,

## **(2) Improvement of Comprehensive Agricultural Development**

According to the internal documents, the irrigation improvement for the planned value (5,700ha of irrigation area) has not completed yet. While the focus has been placed on additional construction/improvement of the facilities (tertiary canal and farm field improvement) to achieve the plan, it seems difficult to establish appropriate improvement standards and to construct/improve tertiary canals and farm fields in order to enable many farmers to participate in the project, as the ex-post evaluation pointed out. Also, it will be more difficult to promote a plan combined with agricultural technology and agricultural finance together. Furthermore, due to frequent consolidation of the executing agencies, no appropriate system was available to plan and promote facility improvement and intangible measures as a package.

## **4. Conclusion, Lessons Learned and Recommendations**

### **4.1 Conclusion**

- As the agricultural productivity is on the increase, the project is considered to have produced certain effects.
- 5,700ha of the irrigation area, the original target, has not been completed yet.
- Regarding maintenance, the agencies in charge of operation and maintenance have frequently changed since 2005 and it is unclear if the adequate systems and sufficient budgets for operation and maintenance are secured. Since some of the problems have happened due to inappropriate daily maintenance, it is assumed that adequate systems and sufficient budgets to perform daily maintenance activities are not secured.
- JGU has no experience of operation/maintenance and collection of fees at present, which is not different from the situation at the time of the study in 2005. However, based on the information that an election will be held at JGU, that the organization will be restructured and that there is willingness of farmers to involve in management of operation and maintenance, it can be said that there are signs of more involvement of JGU in promotion of utilization and operation of the irrigation facilities.

### **4.2 Recommendations**

The executing agencies have been changed from CEDEGE to INAR/MAGAP (INAR) and then to provinces in a short period of time since 2005, and MAGAP (INAR) and Los Rios Province seem to be the executing agencies at present. However, division of the roles among the agencies is not clear. The following are recommendations to the agencies in charge of operation and maintenance of this project, which are based on the recommendations stated in the latest study:

#### (1) Recommendations and Follow-up Activities

##### 1) Conducting Surveys Necessary to Achieve the Original Target

In order to improve the irrigation area of 5,700ha to increase the agricultural production in the subject area, additional construction or improvement of facilities such as tertiary canals and farm fields is an extremely important element. On the other hand, approximately 30 years has passed since completion of the Feasibility Study (F/S) and the social and economic environments around the farmers have changed. Therefore, for future construction/improvement of the irrigation facilities (additional construction/improvement), it is important to understand the changes in the social and economic environments for the farmers because farmers' awareness level about agricultural management and the proportion of the agricultural income in their household budget may have also changed. In other words, the position of agriculture for the farmers may have changed.

Thus, it is necessary to conduct a social and economic survey to clarify the position of agriculture for the farmers, the required scale of additional irrigation facility construction/improvement and the contents of the necessary maintenance of the existing facilities.

## 2) Short- and Medium-term Measures

The efforts should be made to keep the target by effective use of the existing facilities in the short term as more than 10 years have passed since the facility construction.

- To promote the use of irrigation by making the best use of the existing facilities. For instance, to make efforts to make the irrigation easy to use even tentatively, through construction of simple canals (earth canals) and repair of the existing tertiary canals to temporarily connect to the existing main and branch canals.
- To build a maintenance system. For instance, it is difficult for MAGAP (INAR) to perform maintenance activities due to its organizational structure, so daily maintenance is not adequately done and some facilities have got problems. By clarifying the division of the roles between MAGAP (INAR)/the provincial government and the irrigation association, the situation should get better.
- To construct/improve facilities suitable for the farmers' social and economic conditions. Planning and implementation of additional construction/improvement of irrigation facilities based on the current social and economic conditions should be conducted. In order to obtain the information which will become the basis for that, a survey about the farmers' social and economic conditions should be carried out.
- To take measures to improve the existing irrigation utilization ratio by the farmers. Some farmers in the area cannot make a living only with agricultural incomes. These farmers are considered to earn more from jobs other than agriculture. Agricultural incomes even for large-scale farmers may be secondary incomes because they tend to run processing factories. In addition, in Ecuador, there are private companies who offer a cultivation service on a contract basis. Therefore, it is important to make efforts to improve the utilization ratio of the existing irrigation system by the farmers, for instance, by providing and promoting agricultural management models in accordance with the social and economic conditions surrounding agriculture.

## (2) Others

Regarding the outstanding payments for the land which was acquired to construct the facilities, the government of Ecuador should solve the problem as soon as possible in order to dispel residents' distrust of this project.



### (3) Current Situation

MAGAP (INAR) has clarified the issues related to the irrigation project and developed a road map to solve these issues. The agencies and governments (INAR, MAGAP, the provincial government and the municipal government) are conducting surveys in accordance with the road map (started in October 2010). The Ecuador Government is conducting surveys and Japan is supporting<sup>3</sup> it to make the surveys progress efficiently and effectively.

### 4.3 Lessons Learned

The followings are the lessons learned from the way of execution of this project:

- Regarding agricultural incomes associated with the production volume, further income increases can be expected by growing high-value-added varieties. However, it takes time and money to grow such varieties because they require extra effort. Therefore, it is necessary to pay attention to a future possibility that only rich farmers may gain more benefits while peasants who are non-landowner farmers may only gain benefits secondarily through employment as agricultural day laborers.
- Not only facility improvement (infrastructure improvement) but also improvement of measures to promote projects (intangible measures) should be together taken into consideration at the planning stage for making feasible plans and budgets. In the case of this project, it was found that the functions were not fully utilized because of the problems with the irrigation facilities, even though the facilities were completed. This was caused by inadequate daily operation and maintenance due to the inadequate system and the insufficient budget for operation and management because of policy changes and organizational restructuring. In order to solve these problems, for instance, in addition to make strict rules on the procedures of operation takeover in facility transfer, it is important to take certain measures, for example, securing maintenance personnel from the irrigation association and building a mechanism to use irrigation water fees for operating expenses.

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<sup>3</sup> A loan assistance expert (irrigation project) was dispatched from late April to late August 2011.

### Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
<b>1. Project Outputs</b> 1) Sibimbe Plan 1. Construction of head works 2. Irrigation canal 3. Drainage canal 4. Development of fringe farms  2) Catarama Plan 1. Construction of pump station 2. Irrigation canal 3. Drainage canal 4. Development of fringe farms  3) Procurement of agricultural machinery  4) Procurement of maintenance facilities and equipment  5) Embankments in lower basin	1) Beneficial area: 3,470ha 1. Max. flow rate: 5.0m <sup>3</sup> /s  2. 54.0km 3. 52.2km 4. 2,250ha  2) Beneficial area: 2,330ha 1. Max. flow rate: 3.3m <sup>3</sup> /s  2. 28.1km 3. 24.8km 4. 1,850ha  3) Procurement of agricultural machinery 22 tractors, 6 combines, 52 other machines  4) Procurement of maintenance facilities and equipment Project office, workshops, bulldozers, etc.	1) 1. Max. flow rate: 4.85m <sup>3</sup> /s (almost as planned) 2. 42.1km (almost as planned) 3. 56.1km (almost as planned) 4. 796ha  2) As planned 1. Max. flow rate: 2.7m <sup>3</sup> /s (almost as planned) 2. 26.7km (almost as planned) 3. 15.2km (almost as planned) 4. 612 ha  3) Cancelled  4) Cancelled  5) Total: 13.7km Sibimbe 1: 4.8km Sibimbe 2: 7.6km Catarama: 1.3km
<b>2. Project Period</b>	February 1988 – December 1992 (59 months)	February 1988 – December 2002 (179 months)
<b>3. Project Cost</b> Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	6,400 million yen 3,500 million yen 10,110 million yen 8,594 million yen 1 sucre=1.06 yen (As of August 1986)	7,320 million yen 3,560 million yen 10,880 million yen 7,320 million yen US\$1=119.7 yen (Average over 1990 – 2003)