

Senegal

Ex-Post Evaluation of Japanese Technical Cooperation Project
“Integrated Forestry Community Development Project (PRODEFI)”

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0. Summary

This project was implemented with the purpose of improving livelihood and promoting sustainable natural resource management with the participation of local populations in dry land of Senegal. The evaluation in terms of relevance of this project is high since it is consistent with Senegalese development policies, development needs, and Japan’s ODA policy for Senegal. The evaluation in terms of effectiveness and impact is fair since PRODEFI model for sustainable natural resource management was developed, implemented and had achievements in target villages and their neighboring villages. However, this model was not disseminated beyond these villages. The evaluation of efficiency is fair since the initial plan of the main phase was excessive, and had to be modified in the later stage of the implementation, and the extended phase had to be implemented in order to reach the initial goal. The evaluation in terms of sustainability is fair. The project aimed to achieve sustainability in terms of natural resource management in the target areas, and dissemination of the PRODEFI model outside the target area, and the former was achieved and the latter was not. From the above, the overall evaluation of this project is partially satisfactory.

1. Project Description



< Forestry of an assisted village >

1.1 Background

60 percent of the population in Senegal live in villages, and are engaged in the primary industries, which depend on the natural environment. Continued desertification, caused by drought of more than 20 years, mismanaged land development, excessive grazing, and forest fire, is a serious problem since it is

preventing regional development. In view of the fact that these vicious cycles are because of degraded regional ecosystem due to decreased forestry resources, degraded soil, and lack of people's awareness, the Government of Senegal formulated forestry action plan, and is engaged in forestry activities in order to recover the ecosystem. The purposes of this project were to formulate a development model for the management and utilization of village resource, and to promote forestry in villages by Senegalese villagers as main actors, and to support the dissemination of the formulated model for village forestry and village development.

1.2 Project Outline

Overall Goal		Action programs for sustainable management of natural resources are initiated and implemented by local populations.
Project Objective		Main Phase: The extension model of sustainable natural resource management is established in the targeted areas ¹ . Extended Phase: To implement the PRODEFI ² model as natural resource management extension model, improve it, and disseminate it in the target areas.
Outputs: Main Phase	Output 1	The baseline data of natural environment and socio-economic situations are collected.
	Output 2	Training programs to train volunteer farmers are developed.
	Output 3	Training programs are modified and implemented with the participation of farmers
	Output 4	The provisional extension model using the network of volunteer farmers is implemented
	Output 5	Local resources are mobilized by local people with the minimum assistance.
	Output 6	The result of implementing the PRODEFI model is publicized.
	Output 7	Capacity of the PRODEFI project is improved.
Outputs:	Output 1	The basic data of socio-economic situations and ecosystem of

¹ Target area (=project intervention villages) are 30 villages located near Bao Bolong river in Kaolack region. The total population of 30 villages is 10.583.

² The purpose of this project is to design and disseminate a participatory development model named PRODEFI. The features of the PRODEFI model are 1) to implement training programs in the villages, to use local resources (people, material, fund), 3) to be responsive to local needs of training topic such as tree planting and vegetable growing, 4) not to select participants but to allow anyone to participate to encourage maximum participation. The implementation and dissemination of the PRODEFI model is carried out by the government, donor agencies and NGOs.

Extended Phase		target villages are collected.
	Output 2	Training programs are designed in collaboration with people of target villages.
	Output 3	Villagers participate in training programs
	Output 4	The extension model of sustainable natural resource management is practiced by the network of trainees.
	Output 5	Villagers use local resources in order to continue sustainable natural resource management after participating in training programs
	Output 6	Achievements of implemented PRODEFI model become broadly accessible.
	Output 7	Capacity of management, coordination and collaboration of the PRODEFI project is enhanced.
Inputs	<p>Main Phase</p> <p>Japanese Side:</p> <ol style="list-style-type: none"> 1. 17 Experts 8 long-term experts, 9 short-term experts 2. 9 Trainees received 3. Equipment 42.71 million yen <p>Senegalese Side:</p> <ol style="list-style-type: none"> 1. 6 Counterparts 2. Land (for headquarters office, and Niore office) 3. Local Share (Approximately 1.5 million yen) <p>Extended Phase</p> <p>Japanese Side:</p> <ol style="list-style-type: none"> 1. Experts 12 8 long-term experts, 4 short-term experts 2. 4 Trainees received 3. Equipment 9.3 million yen <p>Senegalese Side:</p> <ol style="list-style-type: none"> 1. 6 Counterparts 2. Land (for headquarters office, and Niore office) 3. Local Share (Approximately 8.24 million yen) 	
Total cost	<p>Main Phase: 651 million yen</p> <p>Extended Phase: 216 million yen</p>	

Period of Cooperation	Main Phase: January 15, 2000 – January 14, 2005 Extended Phase: January 15, 2005 – March 31, 2008
Implementing Agency	Directorate for Waters, Forests, Hunting and Soil Conservation, Ministry of Environment and Nature Protection
Cooperation Agency in Japan	Forestry Agency, Ministry of Agriculture, Forestry and Fisheries
Related Projects (if any)	Japan Overseas Cooperation Volunteers (JOCV)

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement of Overall Goal

1.3.1.1 Main Phase

The first indicator of the overall goal was the number of development organizations such as donor organizations and NGOs that implement the PRODEFI model formulated by this project, and the second indicator was the number of villagers that continued to use the model. The project did not have noticeable development in terms of the first indicator at the time of the Terminal Evaluation. The project had the remarkable progress in Nioro in terms of the second indicator.

1.3.1.2 Extended Phase

Overall Goal is expected to be reached in view of various activities such as agreement for cooperation with another project financed by another donor, although no development organizations such as other donors and NGOs implement PRODEFI model.

1.3.2 Achievement of Project Objective

1.3.2.1 Main Phase

The indicators of project objective were accessibility, acceptability, and easiness of the model, and they are still being examined. However, two areas from four areas are about to demonstrate good achievements in these aspects. The project objective is expected to be mostly reached.

1.3.2.2 Extended Phase

The first indicator of the project objective was that the PRODEFI model based on extension network of participants of the training programs is written in English and French, and can be used by others. The draft users' manual was prepared, and was to be finalized before the end of the project. The second indicator is the number of manuals distributed. Forty draft users' manuals were distributed to the Forestry Department, fifty

were distributed to NGOs and other donor organizations in Kaolack. The third indicator was the comments by organizations relevant to the PRODEFI model. The participants of the seminar commented that the model was the appropriate approach for the sustainable natural resource management by the local people.

1.3.3 Recommendations

1.3.3.1 Main Phase

1) The Government of Senegal should use the PRODEFI model developed by the project and should identify other users such as other donors and NGOs that may use the model.

2) The Government of Senegal should continue extension service and monitoring so that they can assist local people to continue their activities by themselves.

1.3.3.2 Extended Phase

1) In order to sustain and further develop project achievements for ensuring autonomous development (sustainability) of project activities, the Forestry Department in Dakar should continue to provide technical support to the local people.

2) It is important for the Forestry Department in Dakar to allocate the budget for vehicle fuel and maintenance in order to ensure the effective assistance of the Niore Forestry Department for the local people.

3) It is important for the Forestry Department in Dakar to approach other donors and explaining PRODEFI model in a plain manner so that they can adopt and implement the model.

In reaction to the above recommendations, the Government of Senegal use PRODEFI model in the target villages and their neighboring villages, and provide technical assistance and monitoring for the villagers. However, they are not approaching other donors to disseminate the model. Other actions taken by the government are discussed in the sections of effectiveness and sustainability.

2. Outline of the Evaluation Study

2.1 External Evaluator

Keiichi Takaki,

Foundation for Advanced Studies on International Development (FASID)

2.2 Duration of Evaluation Study

Duration of the Study: January 2011 – January 2012

Duration of the Field Study:

February 14 – February 28, 2011 & June 1 – June 30, 2011

2.3 Constraints during the Evaluation Study (if any)

None

3. Results of the Evaluation (Overall Rating: C³)

3.1 Relevance (Rating: ③⁴)

3.1.1 Relevance with the Development Plan of [Country X]

The National Plan for Economic and Social Development for 1996-2001 was the development plan of the Government of Senegal when the Main Phase of the project started. This plan included the basic policies with regards to various engagements in areas such as economy, society, food, environment and others. In forestry sector, Forestry Action Plan in Senegal formulated in 1993 was to continue the forestry development action plan formulated in 1981, and this indicated the consistency between development policies and the project at the time of project planning. The Government of Senegal formulated PRSP (Poverty Reduction Strategy Paper) 2003-2005 and PRSP II 2006-2011 and these became the highest development plan for the country. These plans indicated importance of forestry sector and indicated consistency between development policy and the project of the extended phase.

3.1.2 Relevance with the Development Needs of Senegal

60 percent of the population in Senegal is farmers. However, desertification caused by drought of more than 20 years, mismanaged land development, excessive grazing, and forest fire is a serious problem as it is preventing regional development. Since these vicious cycles are because of degraded regional ecosystem due to decreased forestry resources, degraded soil, and lack of people's awareness, the project is consistent with the development needs.

This project is consistent with development issues of Senegal such as sustainable development and the policy measure such as sustainable natural resource management to prevent degrading natural resources. It is also consistent with the local development needs since it is relevant to the policy measures to prevent soil degrading and soil erosion in the groundnut basin region.

³ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁴ ③: High, ② Fair, ① Low

The features of the PRODEFI model developed by the project are 1) its flexibility to meet people's needs, 2) the maximum use of local resources, and 3) its openness of the training programs for any person. These features are consistent with the government (forestry department) that had development of social forestry by people's participation and extension of agroforestry as important challenge, and people's needs that prioritized improved livelihood and living as important issues.

3.1.3 Relevance with Japan's ODA Policy

Japan's ODA policy for Senegal before the implementation of this project was formulated in 1995, and considered environment (prevention of desertification) as the important area. The project included the provision of seedling and afforestation, and thus consistent with the project objective and activities.

From the above, this project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness and Impact (Rating:②)

3.2.1 Project Outputs

3.2.1.1 Project Output

3.2.1.1.2 Main Phase

- 1) Output 1: Collection of the baseline data of natural environment and socio-economic situations

For the purpose of formulating effective project activities, the project collected baseline data of the target villages on the natural environment and socio-economic situations. Thus, Output 1 was achieved.

- 2) Output 2: Training programs are developed to train volunteer farmers
- Output 3: Training programs are modified and implemented with the participation of farmers

Training programs to train volunteer farmers were designed and implemented in 18 target villages with 17 themes for 229 times in total. The running number of 8,689 persons (1,862 males and 6,827 females) participated in the programs. Thus Outputs 2 and 3 were achieved.

- 3) Output 4: The provisional extension model using the network of volunteer farmers is implemented

Participants of the PRODEFI training programs have the high degree of extending the training contents to those who did not participate in the training. For example, three villages in Fimela had training programs on vegetable processing and dyeing, and the participants worked together, using the technique they learned. Since such working places were located in an open space, other villagers often became interested, and as the result, those who did not participate in the training programs also learned the technique from the participants. It was also reported that the participants taught their family members the technique they learned.

Table 1 indicates the number of villagers who can train technique in each area. The comparison between 1999 before the main phase started and 2005 when the project was completed, the number of those who can train technique in tree planting in 1999 was 1.8 and the number of those who can train it in 2005 was 24.3. The number of villages who can teach seedling production and procurement increased from 1.1 in 1999 to 31.6 in 2005. The number of villager who can teach charcoal production and selling increased from 1.1 to 1.9. These indicate that the technique taught in the training programs was disseminated from the participant villagers to others. From the above, Output 4 was achieved.

Table 1. The number of persons who can train others in each village (Average)

Area	1999 Number of persons	2005 Number of persons
Tree planting	1.8	24.3
Seedling production & procurement	1.1	31.6
Charcoal production & selling	1.1	19.1
Stone line	0.9	25.4
Frame dams	0.4	10.3
Vegetable growing	0.7	22.7
Fruit and vegetable processing	0.6	27.0
Livestock fattening	2.3	15.6
Fruit tree	2.0	20.1

(Source: Survey conducted by the evaluator in February 2011 from chiefs of 9 villages which participated from the main Phase. The data are recall of the respondents, thus not accurate.

- 4) Output 5: Local resources are mobilized by local people with the minimum assistance

In order to examine how much Output 5 was achieved, I will first discuss activities in the areas covered by the training programs, and then I will analyze the relations between the resources and activities. Table 2 concerns the average number of villagers who are engaged in activities in each area, and it indicates that those engaged in tree planting increased from 48.1 in 1999 before the implementation to 111.7 in 2000 when the project started and to 149.1 in 2005 when the project was completed. As for seedling production & procurement, it was 11.6 in 1999, and increased to 25.4 in 2000, and to 46.9 in 2005. According to the information provided by JICA, the number of persons in the 9 villages was 317 on average and this indicates that the large portion of the total population of the villages is accounted for by the numbers of villagers active in each area.

Table 2 The number of villagers engaged in each activity (average)

Area	1999 Number of persons	2000 Number of persons	2005 Number of persons
Tree planting	48.1	111.7	149.1
Seedling production & procurement	11.6	25.4	46.9
Charcoal production & selling	0.7	3.8	18.3
Stone line	2.2	17.7	45.1
Frame dams	0.2	5.7	11.1
Vegetable growing	10.9	27.1	39.6
Fruit and vegetable processing	11.9	23.6	45.9
Livestock fattening	2.7	10.6	15.1
Fruit tree	8.2	23.0	32.6

(Source: Survey conducted by the evaluator in February 2011 with from chiefs of 9 villages which participated from the main phase.

The data are recall of the respondents, thus not accurate.

Table 3 indicates the large increase in the number of trees (average) newly planted in 1999 before the project, in 2000 when the project started, and in 2005 when the project was completed, as the average numbers of trees planted were 547.2 before

the project started, and 1,547.2 when the project was completed. According to the village chiefs, the total number of trees planted and remaining in these villages was 5,713. This indicates difficulty of tree planting because of salty soil, harmful insects such as termites and lack of tree planting technique, and this indicates the significant impact of the project.

Table 3. The number of trees newly planted among 9 villages that participated in the main phase.

	1999	2000	2005
The number of trees planted (number/village)	547.2	719.4	1,547.2

(Source: Survey conducted by the evaluator in February 2011 with Chiefs of 9 villages which participated from the main phase.

The data are recall of the respondents, thus not accurate.

Next, I will analyze the degree of activeness in tree planting and the degree of sufficiency of resources necessary for tree planting for which I collected the data in the beneficiary survey in the field survey. (The data were of 60 respondents living in 3 villages of the target village of the main phase, which was randomly selected. The data covers 6 years from year 2000 when the project started to 2005. Refer to the column of this report for the details of data collection procedure.) In this survey, respondents answered the degree of activeness in each activity in five scales (5=very active, 4=active, 3=neutral, 2=not active, 1=not active at all), and the degree of sufficiency of resources such as fund and materials necessary for each activity in five scale (5=much sufficient, 4=sufficient, 3=neutral, 2=not sufficient, 1=not sufficient at all). Table 4 shows the correlations of these two variables and all the coefficients are above 0.8 and statistically significant ($p < 0.01$), close to the perfect correlation of 1.0. This means that villagers own and mobilize resources in accordance with the activeness in each activity. As Tables 2 and 3 showed, villagers were active in each activity, and this analysis supports that activeness in each activity is because of sufficiency of resources. From the above, Output 5 was achieved.

Table 4. Correlations between activeness and sufficiency of resource in each area

Area	Coefficient
Tree planting	0.89
Seedling production & procurement	0.91
Charcoal production	0.97

& selling	
Stone line	0.96
Frame dams	0.86
Vegetable growing	0.86
Fruit and vegetable processing	0.94
Livestock fattening	0.93
Fruit tree	0.91

(All the coefficients are statistically significant. (P<0.01))

6) Output 6: The result of implementing PRODEFI model is publicized.

The first indicator of Output 6 was the publication of the PRODEFI project in English and French and the second indicator is how much well known PRODEFI model was among local people and donor organizations. With regards to the first indicator, “PRODEFI model evaluation report” evaluated actual achievement by using the PRODEFI model, and “PRODEFI model induction paper” explained the concept and summary of how to use the model. With regards to the second indicator, the information provided by JICA reports that the model was well known in the target areas, but was not known in other areas. Thus, Output 6 was not achieved.

7) Output 7: Capacity of PRODEFI project is improved.

The terminal evaluation pointed out that project staff and villagers had communication problems, and whether they were solved is not ascertained.

3.2.1.1.3 Extended Phase

1) Output 1: The basic data of socio-economic situations and ecosystem of target villages are collected.

For the sake of formulating effective project activities, surveys were conducted; Baseline survey report and regional resource survey report were prepared, and used for formulating training programs. Thus, Output 1 was achieved.

2) Output 2: Training programs are designed in cooperation with people of target

Output 3: Villagers participate in training programs

With regards to the training programs, more than 8 training modules⁵ were

⁵ A training module is an element to constitute a training program. Each module

formulated and implemented in 21 villages which participated in the project at the extended phase, and more than 3 modules were formulated and implemented in 9 villages which participated in the project since the main phase. The running numbers of the participants in the training programs were 15,824 (5,002 males and 10,822 females). Thus, Outputs 2 and 3 were achieved.

3) Output 4: Extension model for sustainable natural resource management is being implemented by the network of trainees.

According to the final report of the project, 59.2% of the participants in the training program acquired knowledge and skills, and 50 villagers who did not participate in the training programs learned skills from the participants, and actually used them.

Table 5 indicates the average number of villagers who can train technique in each area in 2005 when the extended phase started and in 2008 in all target 30 villages. The average number of villagers who can train others in tree planting increased from 54.4 in 2005 to 63.7 in 2008, the average number of villagers who can train in stone line increased from 23.9 to 28.8. The average numbers of villagers who can train in all the other areas increased. Thus, Output 4 was produced.

Table 5. The number of persons who can train others in each village (Average)

Area	2005 Number of persons	2008 Number of persons
Tree planting	54.4	63.7
Seedling production & procurement	28.4	34.2
Charcoal production & selling	36.5	46.7
Stone line	23.9	28.8
Frame dams	12.4	16.4
Vegetable growing	40.9	47.2
Fruit and vegetable processing	37.9	47.6
Livestock fattening	11.7	17.9

has a degree of completion. By combining modules, training programs can be designed for different purposes and participants.

Fruit tree	19.0	23.9
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(Source: Survey conducted by the evaluator in February 2011 from chiefs of 30 target villages.

The data are recall of the respondents, thus not accurate.

- 4) Output 5: Villagers use local resources in order to continue sustainable natural resource management after participating in training programs

With regards to the activity situations, the information provided by JICA mentioned the number of participants in the training program on sustainable natural resource management in 2006 was 200 individuals, 29 groups in 2006, and it was 302 individuals and 26 groups in 2007.

In order to examine how much Output 5 was achieved, I will first discuss activities in areas covered by the training programs, and then I will analyze the relations between the resources and activities.

Table 6 concerns the average number of villagers who are engaged in activities in each area from 2005 when the project started in 2008 when it was completed. Those engaged in tree planting increased from 140.1 to 173.7, those engaged in seedling production & procurement increased from 41.4 to 97.4 and those engaged in other activities increased except that the number of those engaged in fruit and vegetable processing slightly decreased. Comparing the increase of the number of villagers active in tree planting between the main phase and the extended phase, the rate of increase of the extended phase is lower as indicated by 48.1 in 1999 before the main phase started and 149.1 in 2005 when the main phase was completed, and 140.1 in 2005 when the extended phase started and 173.7 in 2008 when the extended phase was completed. The possible reason for this different rate of increase is that in the main phase, the training programs already encourage participation from outside target villagers, and those from the villages which became the target from the extended phase already participated in the training programs.

Table 6 The number of villages engaged in each activity (average)

Area	2005 The number of persons	2008 The number of persons
Tree planting	140.1	173.7
Seedling production & procurement	41.4	97.4

Charcoal production & selling	34.4	50.8
Stone line	67.4	73.3
Frame dams	17.1	24.1
Vegetable growing	65.9	71.0
Fruit and vegetable processing	54.7	54.5
Livestock fattening	21.2	26.0
Fruit tree	33.4	39.6

(Source: Survey conducted by the evaluator in February 2011 from chiefs of 30 target villages.
The data are recall of the respondents, thus not accurate.

Table 7 concerns the survey with the village chiefs of 30 villages as the respondents on the average number of trees new planted in 2005 and 2008. It was 2,037 in 2005 when the extended phase was started and it was 2,306 in 2008. Although it slightly decreased from 2005 to 2008, it maintains the same level. In these villages, the average total number of trees planted is 5,889. Although about 2,000 trees are newly planted every year, the total number is 6,000. The reasons can be that some trees were cut and sold, and others did not grow well and died.

Table 7. The number of trees newly planted among 21 villages that participated in the main phase.

	2005	2008
The number of trees planted (number/village)	2,039	2,036

(Source: Survey conducted by the evaluator in February 2011 from chiefs of 30 target villages.
The data are recall of the respondents, thus not accurate.

Next, I will analyze the degree of activeness in tree planting and the degree of sufficiency of resources necessary for tree planting for which I collected the data in the beneficiary survey. (The data were of 40 respondents living in 2 villages of the target village of the extended phase, which was randomly selected. The data cover 4 years from year 2005 to year 2008. Refer to the column for the details of data collection procedure.) In this survey, respondents answered the degree of activeness in each activity in five scales (5=very active, 4=active, 3=neutral, 2=not active, 1=not active at all), and the degree of sufficiency of resources such as fund and materials necessary for each activity in five scale (5=much sufficient, 4=sufficient, 3=neutral, 2=not sufficient, 1=not

sufficient at all). Table 8 indicate the correlation of these two variables and all the coefficients are above 0.8 and statistically significant ($p < 0.01$), close to the perfect correlation of 1.0. This indicates that villages own and mobilize resources as in accordance with the activeness in each activity. As tables 6 and 8 indicated, villagers were active in each activity, and this analysis supports that activeness in each activity is because of sufficiency of resources. The above indicates that Output 5 was achieved.

Table 8. Correlations between activeness and sufficiency of resource in each area

Areas	Coefficients
Tree planting	0.84
Seedling production & procurement	0.92
Charcoal production & selling	0.92
Stone line	0.93
Frame dams	0.93
Vegetable growing	0.89
Fruit and vegetable processing	0.94
Livestock fattening	0.94
Fruit tree	0.93

(All the coefficients are statistically significant. ($P < 0.01$))

- 6) Output 6: Achievements of implemented PRODEFI model becomes broadly accessible.

In accordance with the project final report, the project organized 13 dissemination seminars on planning, implementation and outcomes of the project. For the sake of broad accessibility of the project achievements, the summary of the project final report, the project final report in Japanese and in French, PRODEFI users' manuals in Japanese, in English and in French are available at the JICA web site. This indicates that Output 6 was achieved. However, this has not contributed to the dissemination of the PRODEFI model.

- 7) Output 7: Capacity of management, coordination and collaboration of the PRODEFI project is enhanced.

In accordance with the survey conducted by the project, 93.5% of the 294 respondents are satisfied in terms of income generation activities and capacity

development.

In terms of collaboration with donor organizations, PROGERT (Projet de Gestion et de Restauration des terres dégradées du Bassin Arachidier : Project to manage and recover degraded soil assisted by UNDP and the Global Environment Fund) provided fund to purchase materials necessary for training programs (27 training programs organized in 10 villages: 8 target villages, and 2 villages newly joined the PRODEFI activities) organized by PDL which was established by the PRODEFI project staff at the time of the project completion. However, there was no other collaboration. Thus, the project did not have adequate achievement in collaboration with other donors.

3.2.1.2 Achievement of Project Objectives

- 1) Main Phase: The extension model of sustainable natural resource management is established in the targeted areas.

The indicator was the quality of the PRODEFI model in terms of easiness, acceptability, and easiness in implementation of the model. Training programs are the core of the PRODEFI model, and its main features are that they are organized in target villages, necessary resources such as trainers and materials for the training programs are supplied by the target villages as much as possible, participants are not pre-selected and anybody can participate, and the training programs can flexible and responsive to the needs of local people. Because of these features, the PRODEFI model was accepted by target villages in the extended phase and contributed to achievements of Output 2 (training module designed), Output 3 (training programs implemented). Thus the project objective of the main phase was achieved.

- 2) Extended Phase: To implement the PRODEFI model as natural resource management extension model, improve it, and disseminate it in the target areas.

The first indicator of the project objective is extension model for sustainable natural resource management based on the extension network of the training program participants is available in English and French. The relevant publications are used in villages where PRODEFI is implemented. The summary of the project final report, the project final report in Japanese and in French, PRODEFI users' manuals in Japanese, in English and in French are available at the JICA web site, thus they can be used by an organization that may be interested in the model. However, these are not actually implemented by new organizations and have not contributed to the dissemination of the model. The second indicator is the number of manuals of the PRODEFI model, and forty manuals were given to the Forestry Department, fifty were given to NGOs and

other donor organizations in Kaolack and two were given to others from other areas. However, such manuals given to these organizations did not mean that they were used, the model was adopted and disseminated. Thus, this indicator has no substantial meaning. The third indicator was the comment by organizations relevant to the PRODEFI model. In accordance with the information provided by JICA, the participants of the seminar organized in Nioro in 2007 commented that the model was the appropriate approach for promoting the sustainable natural resource management by the local people. However, such comments did not lead to any organization to adopt the PRODEFI model, and these comments do not reflect the dissemination of the model. From the above, the project objective of the extended phase is not achieved. Over all, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

Next, I will try to analyze why PRODEFI model has not been implemented outside target areas despite the fact that this model was adopted by the target villages and demonstrated its effectiveness. This model has quite unique features in the design of training programs, which are to use village resources such as trainers, to implement training program in the villages without selecting participants so that any person can participate. These are the key features for the PRODEFI model to be effective, and may be difficult to appreciate its effectiveness because of the uniqueness of these features. Although it demonstrated effectiveness in the target villages, there are no other practices. Thus, In order to generate sufficient appreciation of its usefulness and practicability as a policy instrument, organizing seminars to report the project achievements, and giving manuals were not enough. More adequate activities should have been undertaken with sufficient schedule.

The Forestry Department in Nioro continues to use the PRODEFI model, and conduct training programs that use village resources and allows any participants. The possible reasons of why the Forestry Department in Nioro is that they had close relationship with the project such as collaboration in implementing training programs, this allowed them to directly observe the implementation of the training programs and the changes in the lives of villages as the result of the PRODEFI model. The director of the Nioro Forestry Department was newly assigned to the position one month before the time of this ex-post evaluation, and already observed that people who live in the PRODEFI villages are different from those living in other localities in their awareness of tree planting, and activeness in economic activities since he had opportunities to have conversation with people who live in the PRODEFI villages and come to his office to purchase seedling.

This situation that the Forestry Department in Nioro has sufficient understanding about the PRODEFI model and continues to use it suggests the following approach to

encourage dissemination of the PRODEFI model in other regions: The Senegalese Government and donor agencies appoint their personnel to disseminate the PRODEFI model, let them stay in Nioro for a certain period of time, let them engaged in the implementation of the model, and observe the changes in the villages. In this way, they can learn the model, and appreciate its usefulness. This approach would promote the dissemination of the model in other regions.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

The overall goal for both the main phase and the extended phase is “Action programs for sustainable management of natural resources are initiated and implemented by local populations.” The first indicator is the number of other donor organizations and NGOs that use the PRODEFI model, and this evaluation study did not identify any donor or NGOs having adopted the model. The second indicator is the number of those who learned knowledge and skills by the model and use it. From the previous discussion of situations where skills and knowledge of the training programs are disseminated by villagers, the number of villagers who were active in relevant areas, the number trees newly planted, in terms of the second indicator, the overall goal was achieved. From the above, in terms of the second indicator, the goal was achieved whereas in terms of the first indicator, it was not. Therefore, the impact is evaluated as fair.

3.2.3 Impact Evaluation

This evaluation study undertook impact evaluation to examine the project effects. For this purpose, we randomly selected 200 households from both target villages and non-target villages, collected data by administering questionnaires, and analyzed the data with the method of impact evaluation. This section describes the results of the analyses. Details of data collection and analyses are in the column at the end of this report.

Promotion of tree planting was one of the main purposes of the project. However, the analysis of impact evaluation shows that the project did not directly promote tree planting activities. Knowledge and skills were important, but more important was whether they have resources such as fund and materials, and whether they can expect profit from tree planting.

The PRODEFI project emphasized training contents disseminated among villagers. In order to ascertain this effect, I examined the frequency of villagers advising others in tree planting. The result was that the respondents of the target

village advise others on tree planting more frequently than those living in non-target village. This supports the evaluation results that the project achieved Output 4 of the main phase “The provisional extension model using the network of volunteer farmers is implemented,” and Output 4 of the extended phase “Extension model for sustainable natural resource management is being implemented by the network of trainees.”

Training programs of the PRODEFI project emphasized usefulness of cooperation among villagers. I examined the degree by which villagers have benefits of others’ help in tree planting, and the result of the analysis shows that respondents living the target villages have more benefits of others’ help in tree planting those living in the non-target villages, and this indicates that the project promoted cooperation in tree planting among people in the target villages.

Training programs of the PRODEFI project emphasized usefulness of groups for economic activities. Target villages had various groups such as religious group, rural development groups, youth groups, women’s groups, economic interest groups and others. The PRODEFI project emphasized the use of groups in economic groups and had trainings on group management. This evaluation study found that groups many villagers participate are religious groups and rural development groups. The numbers of respondents who belong to the religious groups are 58 out of 100 in the target villages and 49 out of 100 in non-target villages, indicating that there is not much difference. On the other hand, the numbers of respondents who belong to the rural development groups are 36 out of 100 in the target villages and 2 out of 100 in non-target villages, and it indicates the project effect in increasing participation in rural development groups.

PRODEFI training programs taught how to organize groups. In order to find out whether such training improved organization in general, I examined the degree by which villagers are active in group activities, and the degree by which leaders and members of groups in target villages are more cooperative for the purpose of the group. The results of the analyses are that respondents of the target villages are more active in group activity than those of the non-target villages, and leaders and members are more cooperative to serve group purposes, indicating that the project enhanced organizations in the target villages.

PRODEFI training programs emphasized cooperation among villagers and organization. One local resident who were interviewed stated that “although the relationships among the villagers were good, they did not collaborate for economic activities before the PRODEFI project. In the training program, we learned skills and organization with neighbors. As we collaborated in our work, our relationships have become closer.” In order to examine whether this effect is diffused to the whole village,

the result shows that the respondents of the target villages are more cooperative in general than those of the non-target villages, indicating that the project has impact on social relationships in general in the target villages.

3.2.2.2 Other Impacts

Other impacts are promoted organizations within the target villages and enhanced cooperativeness among villagers as discussed in the section of impact evaluation,

3.2.4. Summary of Evaluation

The project objective of the main phase was “the extension model of sustainable natural resource management is established in the targeted areas.” The PRODEFI model was accepted by the target villages in the extended phase and contributed to achievements of Output 2 (training module designed), Output 3 (training programs implemented), and Output 4 (extension of training contents). Thus the project objective of the main phase was achieved.

The project objective of the extended phase is “to implement the PRODEFI model as natural resource management extension model, improve it, and disseminate it in the target areas.” The indicator is extension model for sustainable natural resource management based on the extension network of the training program participants is available in English and French. Although the manuals of the model and other publications are available at JICA website and the manuals are given at seminars, these have not lead to diffusion of the model. Thus the project objective of extension phase is not achieved.

The indicators of the overall goal for both the main phase and the extended phase is the number of other donor organizations and NGOs that use the PRODEFI model, and this evaluation study did not identify any donor or NGOs having adopted the model. The second indicator is the number of those who learned knowledge and skills by the model and use it. The overall goal was achieved in terms of this indicator as the previous discussion of Output 4 and 5 mentioned the number of villagers who were active in areas for which they learned in the training program, and dissemination of the training contents by villagers. Therefore, the impact is evaluated as fair.

With regards to the recommendation by the terminal evaluation, although the Forestry Department in Nioro continue to use the model developed by the project, Senegalese government did not approach other donors and NGOs to explain usefulness of the PRODEFI model so that these organizations may use the model.

From above, although the model was developed and used in the target area, it was not adopted by Senegalese government and donor organizations for dissemination outside the target area. This project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

Main Phase (implemented directly by JICA)

Inputs	Plan	Actual Performance
(1) Experts	3 long-term experts (Specialization: social forestry, rural development, social survey/gender) Short-term experts (as necessary)	8 long-term experts (Specialization: rural development, social forestry, gender) 9 short-term experts (Specialization: PCM method, extension educational method, participatory extension method, conservation of farm land, survey for natural resource management, training for soil conservation, group management, measuring extension, dissemination method)
(2) Trainees received	2 trainees	9 trainees
(3) Third-Country Training Programs	None	None
(4) Equipment		
Total Project Cost	Yen	65,132 million yen
Total Local Cost	Land, buildings, vehicles	Land for Niore office and others Total: 1.5 million yen

Main Phase (Implementation by contracted consultants)

Inputs	Plan	Actual Performance
(1) Experts	1. Chief Advisor (Regional Development)	8 long-term experts (Specialization: social forestry,

	2. Soil conservation/social forestry/extension/public relations 3. Microfinance 4. Gender	project management, information/public relations, soil conservation, microfinance, social survey, gender, regional alliance, forestry management) 4 Short-Term experts
(2) Trainees received		4 trainees
(3) Third-Country Training Programs	None	None
(4) Equipment		Vehicles and others
Total Project Cost		216.71 million yen
Total Local Cost	Land, building, facilities Office for JICA experts Expenses for electricity, gas, water, telephone, purchase of furniture and others	Land Total: 8.24 million Yen

3.3.1.1 Elements of Inputs

The plan of Japanese inputs in the main phase included three long term experts and short term experts as necessary, and the actual implementation required more than the plan as it had eight long term experts and nine short term experts. The plan for the extended phase included four experts that were to cover Chief Advisor/regional development, soil conservation/social forestry/extension/public relations, microfinance, and gender. The actual implementation of the extended phase had four long term experts and four short term experts. Thus, the actual had more experts than the plan.

As of inputs by the Government of Senegal, the agreement between Senegal and Japan for the main phase describes that the Senegalese government was to provide land, building, and vehicle, and the terminal evaluation reports that it provided 1.5 million yen and land. Thus, the actual is below the plan. As of inputs by the Government of Senegal for the extended phase, the plan was to provide land, buildings, facilities, and others, and the terminal evaluation reports that it provided land. Thus the actual is below the plan.

3.3.1.2 Project Cost

The actual total project cost provided by Japan was 651.32 million yen for the main phase and 216.71 million yen for the extended phase. Since the budget at the time of planning is not known, it is not possible to compare the plan and actual. However, the number of experts and other inputs are more than the plan to a large extent and this indicates the actual expenditure is likely to be more than the planned budget.

3.3.1.3 Period of Cooperation

The period of cooperation was extended by the implementation of the extended phase. The terminal evaluation of the main phase pointed out that the initial plan was not realistic and had to be modified to a large extent. The project objective in 2000 was “the dissemination of the model of social forestry and rural development by the local people as the main actors in the target area for soil recovery and ensuring availability of water,” and the outputs were to formulate manuals on skills and management, appropriate agricultural techniques are used, land management are improved among others. Senegalese government stated that after 2-year project implementation, the logical framework did not clearly define the responsibilities within the executing agency, and the relationship between activities and outputs, which resulted in redundancy in activities and delay in implementation. In response to these situations, Senegalese government and JICA agreed in 2002 that the project objective was changed to “The extension model of sustainable natural resource management is established in the targeted areas.” Accordingly, project outputs and activities were modified, and the extended phase was implemented in order to achieve the initial objective. The agreement between Senegalese government and JICA planned the project duration of 5 years (60 months). The extended phase was implemented for 3 years and 3 months (39 months). The ratio of project period between the plan and the actual is 165% (99 months (actual)/60 months (plan)).

On the other hand, the PRODEFI model has unique features: Training programs are implemented in the target villages so that any villagers can participate in them, and resources such as trainers are supplied from the villages. In the process of reaching these unique features, trial and error was the necessary steps, which may delay some schedules. In the extended phase, the model was accepted in the target villages and demonstrates its effectiveness, and its practice still continues at the time of this evaluation study. From the above, the efficiency is fair.

3.4 Sustainability (Rating: ②)

The project final report described that the project aimed to achieve the sustainability in terms of two perspectives: The first perspective is that the people in the target villages continue to practice the natural resource management such as tree planting (sustainability in natural resource management activities) after the project completion. The second is the Senegalese government and other donor organizations use the PRODEFI model designed by the project. Below is the evaluation of sustainability in terms of these two perspectives.

3.4.1 Institutional and Operational Aspects of the Implementing Agency

With regards to the operational aspects of the Niore Forestry Department, two forestry officers are engaged in implementing training programs and monitoring based on the PRODEFI model as part of their regular assignment under the supervision of Department Director. Six JOCVs are assigned, assuming important roles of monitoring and other activities in the PRODEFI villages.

From 2009 to 2010 after the completion of the project, the Forestry Department implemented training programs on the construction of frame dams in three villages, on managing seedling in nine villages, on bee keeping in three villages, and on tree planting in two villages.

The project staff of the PRODEFI established an NGO called PDL (Association Promotion pour le Development Local) and are engaged in expansion and improvement of implementing aspects of the PRODEFI model. PDL has the positions of President, Vice-President, Accountant, and Secretary. These positions are not paid, and PDL does not have stable source of the fund. PDL also does not recruit and train new personnel. After the completion of the project, PDL implemented training programs for 15 times of 6 kinds with 295 participants in 2008, 24 times of 6 kinds with 299 participants in 2009, and 5 times of 5 kinds with 188 participants.

From the above, the operational arrangement to ensure sustainability in the natural resource management activities in the target villages is in order at present. However, at the Forestry Department, JOCVs assume important roles although their future assignments are not ensured, and PDL does not have any stable financial sources, and do not train new staff. These are the causes of some concern in future.

In terms of the perspective of dissemination of the PRODEFI model, neither Senegalese government nor other development organizations adopt and implement the PRODEFI model.

We asked a village chief whether villagers can disseminate the PRODEFI model, and he responded that villagers can teach knowledge and skills they learned in the training programs, but they cannot design, plan, prepare and implement the training

programs based on the PRODEFI model.

3.5.2 Technical Aspects of the Implementing Agency

In accordance with the Niroo Forestry Department and the information provided by JICA, forestry officers have sufficient knowledge and skills in areas such as seedling and tree planting. Technique to disseminate the PRODEFI model is also sufficient since the number of villages adopting the PRODEFI model increased from 30 to 54, and the training programs are conducted after the completion of the project.

In terms of the technique of the villagers, Table 9 concerns the result of the survey conducted for this evaluation with the chiefs of 30 target villages. It shows the average number of villagers who can train others in each area from 2008 when the project was completed to 2010. The numbers of villagers who can train in tree planting were 63.7 in 2008 and 91.1 in 2010. The numbers of villagers who can train in stone line were 28.9 in 2008 and 32.9 in 2010. These indicate the number of villagers who can train others in these areas continue to increase.

Table 9. The number of persons who can train others in each village (Average)

Area	2008 Number of persons	2009 Number of persons	2010 Number of persons
Tree planting	63.7	76.4	91.1
Seedling production & procurement	34.2	35.3	43.7
Charcoal production & selling	46.8	60.0	68.6
Stone line	28.9	29.1	32.9
Frame dams	16.4	19.9	23.0
Vegetable growing	47.2	53.8	53.6
Fruit and vegetable processing	47.6	50.8	56.5
Livestock fattening	17.9	18.9	23.3
Fruit tree	24.0	30.3	37.6

(Source: Survey conducted by the evaluator in February 2011 from chiefs of 30 villages.

The data are recall of the respondents, thus not accurate.

3.5.3 Financial Aspects of the Implementing Agency

The financial aspect of the Nioro Forestry Department is that they have the budget for fuel and maintenance for the vehicle provided by the project. However, the PRODEFI model is implemented together with other regular responsibilities, and has no separate budgetary provision.

3.5.4 Continuity of Effectiveness

Table 10 shows continuity of villagers' activity with the average number of people engaged in each activity. The numbers of those active in tree planting were 173.7 in 2008 and 198.8 in 2010, which is 14% increase. On the other hand, the numbers of those we grow vegetable were 74.1 in 2008 and 62.7 in 2010, which is 11% decrease. Whether or not the number of active villagers increases or decreases depends on the areas. The average numbers of all areas indicate that the number of active villagers increased from 2008 to 2010 by 4%

Table 10 The number of villages engaged in each activity (average)

	2008 Number of persons	2009 Number of persons	2010 Number of persons
Tree planting	173.7	181.0	198.8
Seedling production & procurement	97.4	64.5	74.3
Charcoal production & selling	50.8	58.5	71.0
Stone line	73.3	69.6	73.4
Frame dams	24.1	28.4	30.2
Vegetable growing	71.0	71.9	62.7
Fruit and vegetable processing	54.5	42.8	53.2
Livestock fattening	26.0	25.1	27.5
Fruit tree	39.6	36.7	38.4

(Source: Survey conducted by the evaluator in February 2011 from chiefs of 30 villages.

The data are recall of the respondents, thus not accurate.

The evaluation study conducted the survey and asked chiefs of all 30 villages how effective the PRODEFI model is in the five scale (1=not effective at all, 2=not effective, 3=neutral, 4=effective, 5=very effective), and result was that the average of all the villages was 4.7. The same survey asked them how much the PRODEFI village

increased income of the villagers in five scale (1=not increased at all, 2=not increased, 3=neutral, 4=increased, 5=much increased) and the result was that the average was 4.5.

The results of the above survey on the number of villagers active in each area, and the responses by the village chiefs on the PRODEFI model indicates sustainability of natural resource management activities in target villages is ensured. However, there is some concern of sustainability in future because of uncertainty in the operational arrangement as previously discussed.

In terms of the sustainability of the PRODEFI model, the number of villages participating in the PRODEFI model increased from 30 to 54.

The Nioro Forestry Department continues to implement the PRODEFI model after the completion of the project and organized training in bee keeping in two villages which newly adopted the PRODEFI model, and organized tree planting in one village. In this sense, the PRODEFI model continues to be used. However, the evaluation study did not identify cases where the PRODEFI model was newly adopted. Before the completion of the project, some agreements of collaboration were made. In accordance with PDL, PROGERT (Project to manage and recover degraded soil assisted by UNDP and the Global Environment Fund) provided fund to purchase material necessary for trainings programs organized by PDL from 2008 to 2010 for 27 times in 10 villages. This does not mean that PROGERT adopted the PRODEFI model.

No Senegalese government organizations adopt the PRODEFI model other than the Nioro Forestry Department. The government official who was assigned as the coordinator of the extended phase of the project is now Deputy Director of training center of the Forestry Department in Thies which is 70km east from Dakar, and he appreciates the effectiveness of the PRODEFI model, but is not using it in his duty at the present position.

The activities to disseminate the PRODEFI model at the extended phase were preparation of manuals and organization of seminars, but these have not materialized the adoption of the model by the Senegalese government or donor organizations. This demonstrates that even if an effective model is formulated and publicized, it does not mean that some organization may adopt the model and the model may be disseminated. In order to disseminate the model, publicity was not sufficient, and some arrangements for dissemination were necessary, for which support of a decision maker of an organization or a section that may organize arrangements to disseminate the model is necessary. In order to have the arrangement for the model dissemination and support of a decision maker, there should have been appropriate outputs and necessary activities of the project.

3.5.5 Summary of Evaluation

The main purpose of the project is to formulate and disseminate a model for sustainable natural resource management activity, and the PRODEFI model was formulated but was not disseminated. The training programs are the key for the model and the contents are designed based on the needs of local people on various subjects such as tree planting, soil conservation, growing vegetable and others. They were held in the villages and did not select participants. This allowed many local people to participate in the programs and disseminated skills and knowledge to others, leading to sustainable natural resource management activity.

As for sustainability of natural resource management activity in the target villages, Director of the Forestry Department and Forestry Officers collaborate with an NGO established by the project staff, and organize training programs based on the PRODEFI model after the completion of the project. In this perspective, sustainability at present is ensured. However, there is some concern of sustainability in future since JOCVs have important roles in monitoring and other activities, and their assignment in future to Nioro is not certain.

The number of villages benefiting from the PRODEFI model increase from 30 at the time of project implementation to 54 since additional 24 villages joined from the vicinity.

In terms of the necessary technical level, the Forestry Department in Nioro has sufficient technical level. For the technical transfer of the PRODEFI model, diffusion of knowledge and skills among villagers is important. As the survey result showed, the number of villagers who can train others in various are increasing.

From the above, sustainability of natural resource management activity in the sense of natural resource management activities such as tree planting are undertaken by local people in the target area is ensured, although there is some concern for future. Although the practice of the PRODEFI model expanded in the neighboring villages, the adoption of model may not go farther than this since the model is not adopted by Senegalese government and donor agencies. The diffusion of the PRODEFI model is not ensured.

With regards to the recommendation by the terminal evaluation, diffusion of technique and monitoring are continued to ensure sustainability of activities by people of the target villages. However, there is no action taken to encourage other donors to adopt the PRODEFI model.

From the above, some problems have been observed sustainability of the project is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented with the purpose of improving livelihood and promoting sustainable natural resource management with the participation of local populations in dry land of Senegal. The evaluation in terms of relevance of this project is high since it is consistent with Senegalese development policies, development needs, and Japan's ODA policy for Senegal. The evaluation in terms of effectiveness and impact is fair since PRODEFI model for sustainable natural resource management was developed, implemented and had achievements in target villages and their neighboring villages. However, this model was not disseminated beyond these villages. The evaluation of efficiency is fair since the initial plan of the main phase was excessive, and had to be modified in the later stage of the implementation, and the extended phase had to be implemented in order to reach the initial goal. The evaluation in terms of sustainability is fair. The project aimed to achieve sustainability in terms of natural resource management in the target areas, and dissemination of the PRODEFI model outside the target area, and the former was achieved and the latter was not. In light of the above, the overall evaluation of this project is evaluated partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Effectiveness of the PRODEFI model in the villages are demonstrated and the Government of Senegal stated that the model is effective for the forestry protection activities by the local population. However, appreciation of its effectiveness is not sufficient for the model dissemination outside the Nioro area. Thus, an organization which can disseminate the model should assign its personnel to Nioro for a certain period of time to learn how to implement, and directly observe changes in working situations, and lives in target villages so that he/she can sufficiently appreciate its effectiveness and can be engaged in disseminating the model to other areas.

4.2.2 Recommendations to JICA

The present situation is that the PRODEFI model does not go beyond Nioro areas and there is also some concern of sustainability in Nioro in the future as discussed in the section of sustainability. JICA should have discussion with the Government of Senegal to encourage assigning staff of extension organizations to Nioro so that they can have sufficient appreciation of effectiveness of the model.

4.3 Lessons Learned

When a project has the objective of establishing a model and its dissemination, the effective way of promoting implementation and dissemination of the model by the government organization is to provide opportunities to experience the implementation of the model.

If officials of government organization which may disseminate the model participate in the formulation and implementation of the model, they can observe changes in reality, and this would significantly contribute to improving their motivation to disseminate the model to other areas.

Reason:

Although the PRODEFI model had good achievements, and is still used by the Forestry Department, an NGO, and the target villages in Nioro, it has not been implemented outside Nioro. The project prepared manuals, and organized seminars in order to publicize the usefulness of the model. However, it did not lead to dissemination of the model outside Nioro, and this indicated that publicity is not sufficient.

The possible reason why the Nioro Forestry Department continues to use the model after the completion of the project is that the Forestry Department directly observed the changes in the lives in the target villages through the cooperation in project implementation, and had sufficient appreciation of the meaning and effectiveness.

Capacity Development (CD) discussed by JICA recently is defined as the process by which capacity is developed to deal with problems at the multiple levels such as individuals, organizations and society. As the section of impact evaluation discussed, the PRODEFI model contribute to improving capacity not only at organizational level, but also organizational and community levels. Thus, the training style of the PRODEFI model can be effective in promoting CD.

Column

1. Purpose

This evaluation study undertook impact evaluation to measure the project effects, taking into account unique features of the PRODEFI model. Training programs of this mode was implemented in the target villages, allowing any participants so that the skills and knowledge taught at the training programs would be broadly disseminated to the local population including those who did not participate in the programs. An example of this indirect effect of the project was discussed in the section of Output 4 of the main phase: members of a women's group who participated in the training program taught their members knowledge and skills they learned. Project effects to be examined are as below.

① To examine how much the promotion of tree planting, one of the main objectives of the PRODEFI project, was achieved.

② The PRODEFI project emphasized the dissemination of the training contents among participants in the village. In order to examine its effectiveness, I will examine how often villagers advise others on tree planting.

③ The PRODEFI project emphasized usefulness of cooperation among villages for tree planting and other activities. I will examine how much of cooperation with others villagers had for tree planting.

④ Target villages had various groups such as religious group, rural development groups, youth groups, women's groups, economic interest groups and others. The PRODEFI project emphasized the use of groups in economic groups and had trainings on group management. I will examine what effect such training had for improving group activities in the villages by examining ④-1 How actively villagers are engaged in the group activities they belong to, and ④-2 How cooperative leaders and members of groups respondents belong to for the sake of serving the groups

⑤ As described in project effect ④, PRODEFI training programs emphasized cooperation among villagers and organization. In the interview undertaken in the target village one resident stated that "Although the relationships among the villagers were, they did not collaborate to undertake economic activities before the PRODEFI project. In the training program, we learned skills and organization with neighbors. As we collaborated

in our work, our relationships have become closer.” In order to examine whether this effect is diffused to the whole village, I will examine how much villagers became cooperative with one another in general.

2. Data Collection Procedure

For this impact evaluation, questionnaires were administered for data collection both at target villages and non-target villages. To make meaningful comparison of target villages with non-target villages, selected are 30 non-target villages similar to the target villages in terms of natural environment and socio-economic attributes such as economic activities and income.

The respondents to the questionnaires were selected by two-stage random sampling. First, 5 villages were randomly selected from target and non-target villages respectively, making 10 villages in total. Then, 20 households were randomly selected from each village, making 200 households in total. Household heads were the respondents of the questionnaire, and the data were collected from 1999 to 2000 for 12 years by the respondents' recollection.

3. Analytical Method of the Project Effects

This impact evaluation examines the project effect at the target villages, and this method requires careful examination of how such villages are selected since this selection process may bias the result of the examination. In selecting the target villages, the project staff visited candidate villages and organized meetings to explain about the project and selected the villages where people were willing to participate. Because of this selection procedure, the project effects that are previously discussed may not be solely attributable to the project. For example, villages willing to participate in the project may be more active in tree planting than non-target villages before the project implementation. Regarding the project effect ⑤ discussed above, the villagers may be already cooperative with one another and this may have facilitated consensus building to participate in the project. Table 1 is the comparison of project effects in 1999, one year prior to the project implementation. Project effects are put into numerical value and the numbers in the table are averages for respondents of target villages and those of non-target villages. This indicates that project effects are higher for villagers living in target villages than those living in non-target villages. I will explain the definition of numerical value of project effects later.

Table 1 Comparison of project effects
between target villages and non-target villages in 1999

	Degree of activeness in tree planting	Degree of advising others	Degree of having benefits of others' help	Degree of activeness in group activities	Degree of cooperativeness of group leaders and members
Target villages	1.80	1.32	1.05	0.88	0.88
Non target villages	1.72	1.25	0.85	0.56	0.60

In order to have the precise examination of the project effect, it is important to remove the conditions which already existed in the villages before the project implementation. Instrumental variable method statistically removes such conditions which were not caused by the project implementation. For example, in order to identify the project effect in promoting activeness in tree planting, the degree of activeness in tree planting which already existed before the project has to be removed. For this purpose, I use two stage instrumental variable regression analyses.

In selecting the instrumental variable, it has to fulfill two conditions. Firstly, it has to be correlated with the chance that the village is selected as the target village. Secondly, it has only indirect effect on the project effect through target village.ⁱ

The instrumental variable here is “the strength of villagers’ willingness to take advantage of new opportunities.” If there are more villagers that are willing to take advantage of new opportunities, the probability that the village is selected by the project. Thus, this fulfills the first condition of the instrumental variable.

With regards to the second condition that instrumental variable should have only indirect influence on the project effect through being target village, I will examine for each project effect.

① “Degree of activeness in tree planting”

According to my interviews with villagers, they mentioned that many villagers attempted tree planting by themselves, but they could not continue because of salty soil and other problems. They continued to plant trees only after learning knowledge and skills to deal with these problems. In other words, they need to have knowledge and skills first, and just having willingness to take advantage of new opportunities does not mean that they are active in tree planting. Thus, the instrumental variable fulfills the second condition for this project effect.

② "Frequency of advising others on tree planting"

In order to advise others on tree planting, they need to have knowledge first. Thus, just having willingness to take advantage of new opportunities does not mean that they can advise others. Thus, the instrumental variable fulfills the second condition for this project effect.

③ "Degree of benefits of others' help in tree planting"

In order to have others' help, they need to have someone who can help, or they have to be in a situation where they can be helped. Thus, people's willingness to take advantage of new opportunities does not have direct influence on this project effect, and the instrumental variable fulfills the second condition.

④-1. "The degree of activeness by which respondents participate in group activities"

This depends on what kind of activities groups are engaged in. If a group continues with the traditional activities and do not engage in new activities, respondents may not be actively involved in group activities even if they are willing to take advantage of new opportunities. Thus, the instrumental variable fulfills the second condition for this project effect.

④-2. "The degree of cooperativeness of leaders and members of groups to which respondents belong"

This depends on group leaders and members, and the respondents' willing to take advantage of new opportunities would not have direct influence on this effect. Thus, the instrumental variable fulfills the second condition for this project effect.

⑤ "The degree of cooperativeness of villagers with one another"

This depends on people in the village, and the respondents' willing to take advantage of new opportunities would not have direct influence on this effect. Thus, the instrumental variable fulfills the second condition for this project effect.

From the above, the second conditions to be an instrumental variable are met.

4. Variables

Next, I will discuss variables and their possible values. First, I will discuss variables for project effects, then, instrumental variable, and control variables.

4-1. Project Effects

To capture the project effects discussed above, I used below questions with the possible values in parentheses.

- ① How much active are you in tree planting? (5=Very active, 4=active, 3=fairly active, 2=not active, 1=not active at all)
- ② How often do you advise others in tree planting? (5=always, 4=often, 3=sometimes, 2=rarely, 1=never)
- ③ How much collaboration with others do you have in tree planting? (5=very much of collaboration, 4=much collaboration, 3=fair amount of collaboration, 2=no collaboration, 1=no collaboration at all, 0=if not engaged in activities at all)
- ④-1 How much people in village are cooperative with one another? (5=much cooperative, 4=cooperative, 3=fairly cooperative, 2=not cooperative, 1=not cooperative at all)
- ④-2 The degree by which respondents are active in group activities (5=Very actively, 4=actively, 3=fairly actively, 2=not actively, 1=not actively at all)
- ⑤ The degree by which leaders and members of group the respondents belong to are cooperative with one another. (5=Very much, 4=much, 3=fairly, 2=not much, 1=not at all)

4-2. Project Inputs

The PRODEFI project emphasized interactions of participants of training programs and non-participants for the transmission of training contents outside the training settings. In order to capture this broad process of project inputs, I will compare those living target villages where such interactions happened with those living in non-target villages where such interactions did not happen. Thus, the variable to capture this project input is whether a respondent lives in the PRODEFI target village. (1=respondents of target villages, 0=residents of non-target village)

4-3. Instrument Variable

The question and its possible values for the instrumental variable discussed above are as below.

How often did you try to take advantage of new opportunities such as training programs like PRODEFI to improve your life? (5=Always, 4=often, 3=sometimes, 2=once in a while, 1=never)

4-4. Control Variables

In order to control for the variable that may influence the project effects, I will include below control variables.

The degree of sufficiency of resources such as fund and material necessary for tree planting (5=Very much, 4=much, 3=fair, 2=not sufficient, 1=not sufficient at all), the degree by which they can expect profit from tree planting (5=very profitable, 4=profitable, 3=neither profitable nor unprofitable, 2=not profitable, 1=not profitable at all), age, literacy in French (1=literate, 0=illiterate), literacy in mother tongue (1=literate, 0=illiterate). The ethnic groups which respondents belong to are Wolof, Soninke, Sereer, Fulani, Manin and other groups. The analysis concerns the comparison between the ethnic group a respondent belong to and other ethnic groups.

5. Analysis: the first stage regression model

The first stage regression model concerns removing the conditions which are not project effect. The model can be captured by the below equation.

$$\begin{aligned} \text{Target village}_{it} = & \beta_{0t} + \beta_1 \text{opportunity}_{it} + \beta_2 \text{resource}_{it} + \beta_3 \text{profit}_{it} + \beta_4 \text{age}_{it} \\ & + \beta_5 \text{literacy(French)}_{it} + \beta_6 \text{literacy(mother tongue)}_{it} + \\ & \beta_7 \text{Wolof}_{it} + \beta_8 \text{Soninke}_{it} + \beta_9 \text{Sereer}_{it} \\ & + \beta_{10} \text{Fulani}_{it} + \beta_{11} \text{Maninka}_{it} + \varepsilon_{it} \end{aligned}$$

The variable to capture project input is “Target village_{it}” and this indicates whether the village where a respondent_i lives are the target village in year_t. Opportunity_{it} is the instrumental variable and indicates the degree of willingness to take advantage of new opportunities of a respondent_i in year_t. Resource_{it} is the degree by which a respondent_i has the sufficient resource such as fund and material in year_t. Profit_{it} is the degree by which a respondent_i can expect profit in tree planting in year_t. Age_{it} is age of a respondent_i in year_t. Literacy(French)_{it} concerns whether a respondent_i is literate in French. Literacy(mother tongue)_{it} concerns whether a respondent_i is literate in his/her mother tongue. Wolof_{it} concerns whether a respondent_i is Wolof. If the respondent_i is Wolof, this variable takes the value of 1 and Soninke_{it}, Sereer_{it}, Fulani_{it}, and Maninka_{it} take the value of zero. ε_{it} concerns the error not explained in the analysis with regards to the factors that influence the village of respondent_i becomes the target village.

Table 2 concerns the result of the first stage model, and “opportunity” instrumental variable (opportunity) is statistically significant (P<0.01) and shows that I can use it as the instrumental variable.

Table 2 First Stage Regression Model

Variables	Coefficient
Opportunity	0.05***
Resources	0.11***
Profit	-0.03**
Age	0.00***
Literacy (French)	0.06***
Literacy (mother tongue)	0.05**
Wolof	0.09
Soninke	0.08
Sereer	-0.12*
Fulani	0.02
Maninka	0.00
Intercept	-0.13

***P<0.01 **P<0.05 *P<0.1

6. Results of the Second Stage Regression Analyses

Next are the results of the second stage regression analyses, and this shows whether project input has impact on the project effects. Table 3 shows the coefficients of each variable for each project effect. For the coefficients that are statistically significant, I put asterisks. I discuss the project effect as below.

① "Degree of activeness in tree planting"

It is not statistically significant. This may be because the degree of activeness in tree planting does not depend on whether they live in the project target village. More important is whether they have funds and materials necessary for tree planting.

② "Frequency of advising others on tree planting"

The analysis shows that the respondents of the target village more frequently advise others on tree planting than those living in non-target village ($p<0.05$). This supports that the project achieved Output 4 of the main phase "The provisional extension model using the network of volunteer farmers is implemented," and Output 4 of the extended phase "Extension model for sustainable natural resource management is being implemented by the network of trainees."

③ “Degree of benefits of others’ help in tree planting”

The analysis shows that respondents living the target villages have more benefits of others’ help in tree planting those living in the non-target villages ($p < 0.05$), and this indicates that the project promoted cooperation in tree planting among people in the target villages.

④ The analysis shows that respondents living the target villages are ④- 1 more active in activities of group they belong to than those living in non-target villages ($p < 0.01$). It also shows that ④- 1 leaders and members of the group in target villages are more cooperative for the purpose of the group ($p < 0.01$), and this indicates the project enhanced organizations in the target villages.

⑤ The analysis shows that people living in the target villages are more cooperative with one another in general ($p < 0.01$), and this indicates that the project promoted cooperation among people in the target villages in general.

Table 3 Analyses of Project effects by Instrument variable method

	Active in tree planting	Advising others on tree planting	Benefits of others’ help in tree planting	Active in group activities	Group leaders and members are cooperative	Villagers are cooperative
Target village	0.19	0.79**	0.48**	1.13***	1.06***	5.76***
Resources	0.12***	0.11**	0.48***	-0.08*	-0.08*	-0.80***
Profit	0.65***	0.35***	0.47***	0.11***	0.10***	0.36***
Age	0.00	0.00	-0.00	0.00	0.00	-0.01***
Literacy (French)	0.09**	-0.18***	-0.16***	-0.07	-0.07	-0.68***
Literacy (mother tongue)	0.11***	-0.27***	0.23***	0.51***	0.46***	0.03
Wolof	0.06	0.62**	0.00	0.08	0.03	0.20
Soninke	0.10	-0.00	-0.13	-0.81***	-0.91***	-0.15
Sereer	0.19	0.06	0.12	-0.35**	-0.44**	0.77*
Fulani	0.01	0.14*	-0.02	-0.18**	-0.20**	0.11
Maninka	0.14**	0.68***	-0.19**	0.11	0.11	0.62*
Intercept	0.88***	0.44	-0.03	0.88***	1.07***	2.90***

***p<0.01 **p<0.05 *p<0.1

ⁱ Eisenberg, Daniel and Brian C. Quinn. 2006 “Estimating the Effect of Smoking Cessation on Weight Gain: An Instrumental Variable Approach. Health Research and Educational Trust. 41:6 (December), p. 2258