



Economic cost- effectiveness

**an important
criterion in
IPM**

**Economic analysis of
CATIE MIP/AF (NORAD) Program in Nicaragua**

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The Regional CATIE IPM/AF (NORAD) Program

The Regional CATIE IPM/AF (NORAD) Program is an initiative which began in 1989 to strengthen national Integrated Pest Management (IPM) capacity in Nicaragua. The Program consisted of three phases. In the third phase, which began in 1999, the Program worked in IPM and agroforestry with around 7.000 farm families, 300 extensionists, 60 specialists and 70 decision-makers from about 70 Nicaraguan organisations.

The Program's methodology consisted of simultaneous linked cycles of workshops for groups of specialists, extensionists and farmers, who participated in training based on crop growth stages, aimed at improving their decision-making capacity in pest, crop and tree management.

In order to carry out and coordinate the training activities at a national level, the Program encouraged the formation of regional groups organised by theme or by crop, which were made up of members of organisations working in each region, and of groups of national-level specialists. These groups formed the central pillar of the Program's work, and were in their turn coordinated by a committee known as the National IPM Committee (CN-MIP).

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What is this leaflet about?

This leaflet presents information on the results of a cost-benefit analysis of the CATIE IPM/AF (NORAD) Regional Program, emphasising what needs to happen over the next five years so that the investment made by the Program shows even greater returns.

What was the purpose of this study?

The goal of this study was to make a quantitative analysis of the Program's impacts, comparing the investment made with the economic benefit achieved.

The results serve as a means of evaluating the Program, as well as providing information which can be used to plan future activities promoting IPM in Nicaragua.

How was the study conducted?

The study was conducted in three stages:

1. Standard cost-benefit analysis.
2. Stochastic simulation to incorporate uncertainties in the assumptions made about the benefits.
3. Presentation of the results to a group of specialists and decision-makers for them to make adjustments to the assumptions and thus to the results of the analysis.

Why analyse cost-effectiveness?

An economic analysis which tries to incorporate the costs and benefits of a project has several aims:

First of all, both donors and actors in the national arena need to be able to justify the investment of public funds in a project, and need to know whether the benefits will make the costs worthwhile.

However, an economic analysis must answer many other questions:

Will the beneficiaries be able to make economic gains at farm and family level?

If they cannot do so, they will probably not continue to use IPM practices after the project has ended.

What are the most important costs and benefits?

Are there key benefits on which the economic success of the project depends?

It should also provide information about which factors constrain the project.

What political conditions would enhance or limit the impact of a project?

So a cost-benefit analysis is not only an evaluation of a project which is drawing to a close, but should help in the process of drawing up and planning new, improved projects.

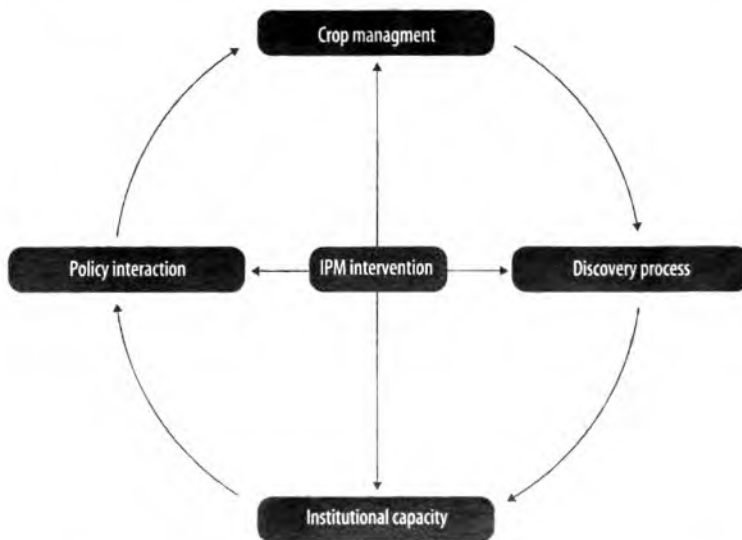


What is the purpose of the CATIE IPM/AF (NORAD) Program?

The goal of the CATIE IPM/AF (NORAD) Program was to improve crop and pest management in four crops which are important for Nicaragua (coffee, basic grains, vegetables and plantains/bananas).

The principal concept on which the work was built was that of strengthening the capacity of farm families to analyse the situation in their crops, and to take better and more opportune decisions, such that they begin to experiment and to develop their own methods of pest management.

Recognising that crop management, the process of experimenting, institutional capacity, and agricultural policies are inter-related, the Program also concentrated on supporting and strengthening institutional capacity in Nicaragua, with the goal of creating more favourable conditions for IPM implementation in rural communities, in private organisations and in government bodies.



How can we analyse the costs and benefits of the CATIE IPM/AF Program?

The challenge of a cost-benefit analysis is, in fact, to be able to identify and measure the costs and benefits.

The Program's framework of intended impacts can be used as a guide to define these costs and benefits.

Individual farm level

Costs

- Use of pest control agents
- Use of on-farm resources
- Opportunity costs of labor (time for training, field monitoring and cultural control practices)
- Protective clothing

Benefits

- Saving in pesticide expenditure
- Effects in soil fertility and yields
- Increased stock of beneficials
- Community action
- Effects on health
- Knowledge about agro-ecosystem
- Avoiding pesticide resistance
- Broader range of pest control options

National economy

Costs

- Costs of IPM training
- Administrative overheads
- IPM-related research
- Evaluation, policy workshops

Benefits

- Effects on consumers' health
- Effects on biodiversity
- Pollution levels of ground and surface water



What are the difficulties when we come to measure the impacts?

There was no great difficulty in measuring the costs of the CATIE IPM/AF (NORAD) Program because the farm-level expenses, the expenses of counterpart organisations and those of the Program itself served as an estimate of the costs.

Measuring the benefits was more complicated given that some benefits (productivity, yield, price) are tangible and can be valued using their market prices, whereas others (effects on health or on the environment) are intangible and cannot be assigned a commercial value.

So where does the data used in the economic analysis come from?

- 1. Internal program monitoring (1999-2002)**
 - Knowledge of farm households
 - Pest damage
 - Crop yields
 - Pesticide use
 - Quality of produce
- 2. Participatory beneficiary assesment**
(Kuan et.al., 2001)
 - IPM implementation
 - Inputs and labor
 - Yields and quality
 - Estimates for gross return
- 3. Pesticide exposure and intoxication in farmers**
(Corriols, Silba et. al., 2001; Corriols, 2002)
- 4. Statistical evaluation (Dumazert, 2002)**
 - Coverage and IPM adoption
 - Adoption rate
 - Types of farm households
 - Production cost, yields, incom
- 5. IPM training impact on health**
(Hruska y Corriols, 2002)
 - Impact on reduction of pesticide use
 - Yield and return
 - Saving from pesticides
- 6. Reference data for agricultural production**
(MAGFOR, 2002)
- 7. Conversion factors for economic analysis**
(World Bank, 2000)

What were the costs of the CATIE IPM/AF Program?

When calculating the costs, we included the operational costs of the Program. This included costs incurred in research, training of extensionists, the organisation of the specialists' groups, transport, salaries and materials. We also included administration costs, and the costs of studies, consultancies and monitoring and evaluation.

For counterpart and beneficiary costs, we included the cost of specialists and of participating farmers' time, as well as the cost of their experiments.

Finally, we calculated the average cost of follow-up to IPM training, undertaken by national organisations after the Program's financing terminates.

Costs of Program in US\$

	1989-1997	1998-2003	2004-2008
Field costs (implementation)	–	1,710,116	–
Salaries, transport, office, advisory	3,482,496	1,849,046	–
Labor cost in counterparts organizations and farmers	–	3,048,496	2,000,000
Total	3,482,496	6,607,658	2,000,000

Number of farm households

Coffee	–	15,983	8,000
Food grains	–	3,495	2,000
Vegetable	–	8,190	4,000



What were the Program's benefits?

Quantification of the benefits was limited by lack of data. The quantitative benefits that the Program aimed to achieve were: improved yields, reduced expenditure on pesticides, better prices due to improved quality of crops, and a reduction in health costs due to pesticide poisoning. However, there was only evidence of an increase in yield in coffee. Effects due to changes in the prices of agricultural produce were not included. There was a reduction in production costs in basic grains, coffee and vegetables.

	Effect		Source
Coffee			
Yield increase	4.6	qq pergamino/mz	(Dumazert 2002)
Reference price	32.5	US\$/qq pergamino	(CATIE 2002)
Savings in pesticide expenditure	42	US\$/mz	(CATIE 2002)
Area	4.25	mz*	(Dumazert 2002)
Adoption rate	35.6	%	(Dumazert 2002)
Maize			
Savings in pesticide expenditure	61.9	US\$/mz	(Hruska and Corriols 2002)
Area	1.7	mz*	(Dumazert 2002)
Adoption rate	35.6	%	(Dumazert 2002)
Beans			
Savings in pesticide expenditure	32.5	US\$/mz	(CATIE 2002)
Area	1.7	mz*	(Dumazert 2002)
Adoption rate	35.6	%	(Dumazert 2002)
Vegetables (two crops/year)			
savings in pesticide expenditure	31.5	US\$/mz	(CATIE 2002)
Area	1.7	mz*	(Dumazert 2002)
Adoption rate	35.6	%	(Dumazert 2002)

* 1 mz= 0.7 ha

Was investment in the CATIE IPM/AF (NORAD) Program economically efficient?

To calculate the efficiency of the investment cost-effectiveness of the Program we compared the costs and benefits.

The net present value (NPV) represents the value of the benefits less the costs, applying the reference rate of interest in order to value the time delay before the benefits are realised. The costs incurred today are of relatively higher value than those which must be paid in several years' time. Future costs and benefits are also discounted in relation to initial costs.

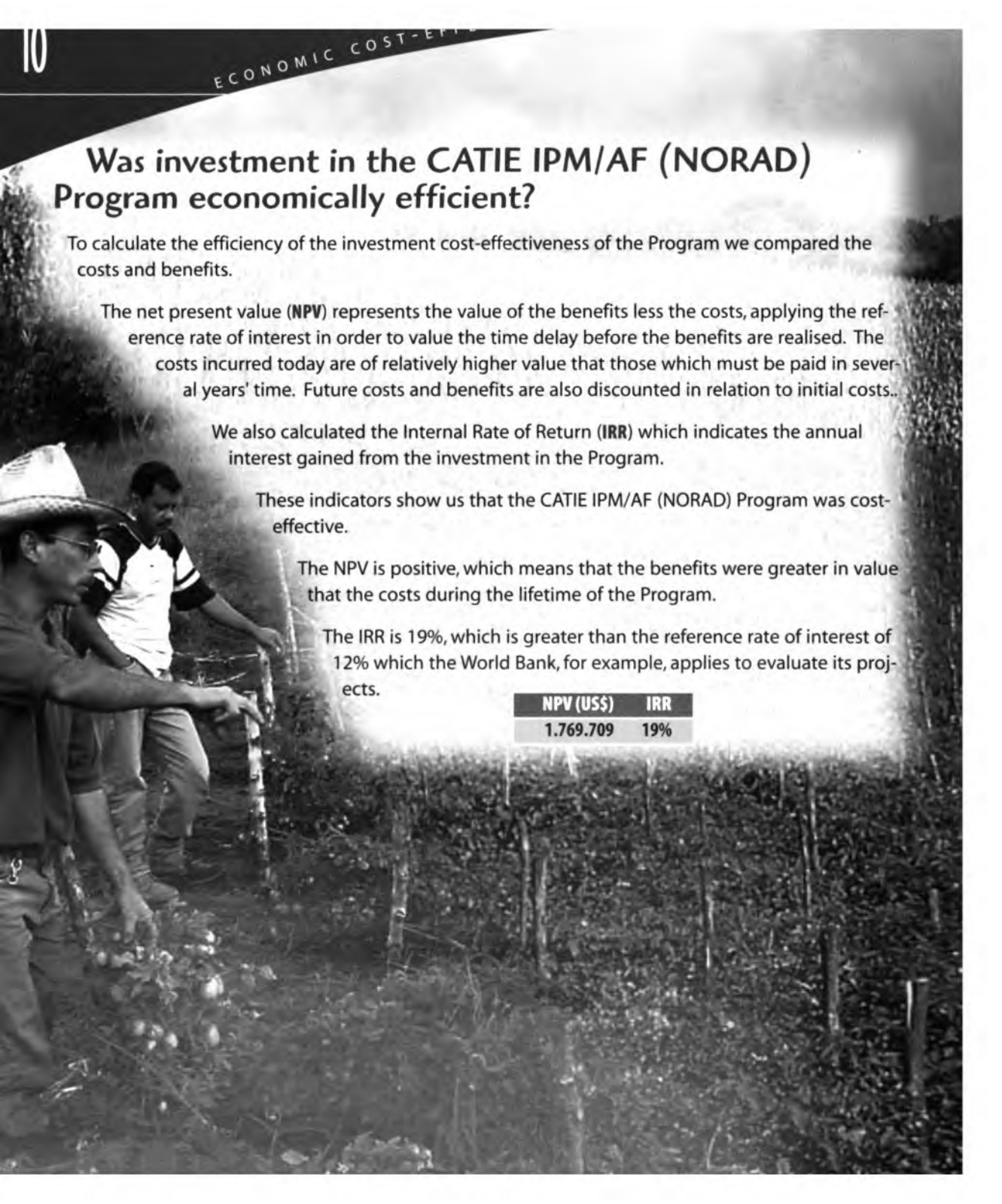
We also calculated the Internal Rate of Return (IRR) which indicates the annual interest gained from the investment in the Program.

These indicators show us that the CATIE IPM/AF (NORAD) Program was cost-effective.

The NPV is positive, which means that the benefits were greater in value than the costs during the lifetime of the Program.

The IRR is 19%, which is greater than the reference rate of interest of 12% which the World Bank, for example, applies to evaluate its projects.

NPV (US\$)	IRR
1.769.709	19%



What does cost-effectiveness investment efficiency depend upon?

In order to calculate which factors cost-effectiveness depended upon most, we calculated the NPV for different scenarios, asking ourselves:

What would happen if there had been no yield increases?

What impact did the price of coffee have on the Program's cost-effectiveness?

What would happen if no more training took place after the Program finished in 2004?

The results of this analysis show that the most important economic benefit from the Program was the coffee yield.

In terms of the Program's sustainability, we need to be able to ensure that farmers who adopted IPM go on obtaining the benefits of having changed their farming systems, even though the Program comes to an end.

It is also important that the counterpart organisations go on training new farmers in the methods used by the Program.

Reducing production costs did not have an over-riding effect on the Program's cost-effectiveness.

	NPV (US\$)	IRR
Baseline situation	1,769,709	19%
Increase in yields = 0	-2,614,470	-3.1%
Price of coffee decreases to 18.6\$	-102,337	11.6%
Reduction in pesticide expenditure = 0	-43,831	11.9%
No more training takes place after 2003, and trained farmers do not continue using IPM	-1,368,271	1.5%
No more training takes place after 2003, but trained farmers continue using IPM	224,598	12.9

How reliable are the results?

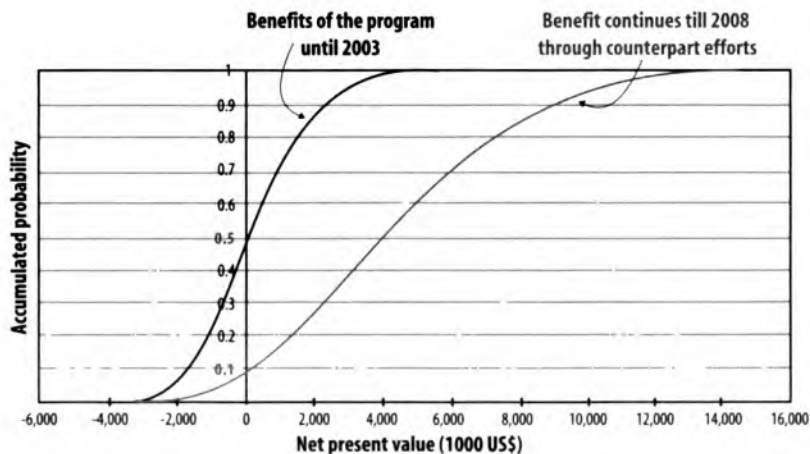
In a standard cost-benefit analysis, the NPV and the IRR, which are the indicators of cost-effectiveness, are calculated using average beneficiary values. However, many factors can generate uncertainty about whether the effects measured are real.

In order to take this uncertainty into account and to obtain more information, it is useful to use a stochastic simulation which allows us to consider a range of possible beneficiary values instead of a fixed figure.

Running this simulation therefore provides us with a range of possible NPVs, and we can calculate the probability of obtaining a specific NPV. For example, we can calculate the probability of obtaining at least one NPV of zero, which would mean that the benefits exactly balanced the costs using the reference rate of interest.

We calculated two scenarios:

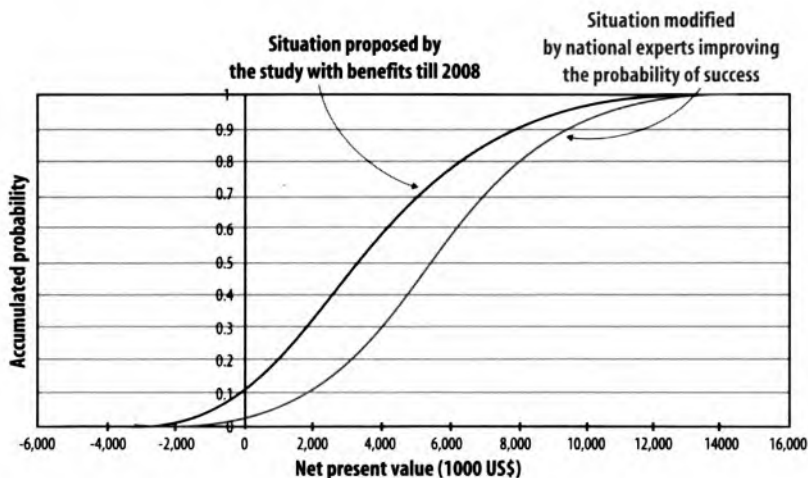
- ◆ First we supposed that farmers continued to get the same level of benefit for five more years and that the collaborating organisations continued to train new farmers for the next five years. In this case, the probability of the Program achieving net benefits was **90%**.
- ◆ If, on the other hand, the impact of the Program was to disappear when the finance ran out, the Program would have a **50%** probability of not being cost-effective.



What did IPM stakeholders in Nicaragua have to say?

In June 2003, representatives of the Ministries of Agriculture and of Health, members of the Program's counterpart organisations and of the universities involved in the Program's work were invited to a workshop to evaluate the impact of the Program.

These actors contributed to the economic study by analysing and adjusting the assumptions which were used in the calculations. In effect, we asked them to determine the range of possible benefits, which resulted in significant changes.



The following changes were proposed by the IPM stakeholders:

- Lower average coffee price
- Lower and higher rates of adoption in basic grains and in vegetables.
- An increase in yield and a larger area farmed per farmer were included for both basic grains and vegetables.
- The impact at the level of collaborating organisations was viewed more optimistically.
- The number of new farmers trained was reduced in coffee but increased in basic grains and in vegetables.
- Health benefits were excluded due to lack of sufficient data.

Although the assumptions made by stakeholders, which were incorporated in the cost-benefit study, were more optimistic, there is still the possibility that the Program investment will not be efficient.

Hopefully, decision-makers in those organisations involved will take these results on board, and will insist that activities which favour IPM in Nicaragua are implemented, so that the Program's impact can be maximised.

What have we learned from this study?

In this study we have shown that it is important to work both with farmers and with national organisations. The goal at farm level is better crop and pest management, but this cannot be achieved if we do not manage to involve decision-makers in organisations which could create political conditions which would favour the implementation of IPM.

On the other hand, without long-term follow-up, the Program is not cost-effective.

The CATIE IPM/AF (NORAD) Program's concept of working at different levels with organisations involved in IPM has contributed to ensuring the impact achieved at farmer level.

We have also learnt that an economic study can be an effective tool for communication, if the assumptions made are explained transparently. Involving IPM stakeholders enabled us to produce a reliable economic study in a data-poor situation. The uncertainty of the data was reduced, and at the same time the probability that decision-makers will use the study to plan future activities was increased.

The Wider Lessons Studies

This leaflet forms part of the Wider Lessons Studies (WLS) which consist of:

- A qualitative study on how and why the CATIE IPM/AF (NORAD) Regional Program has had an impact on the different levels of participants who were involved in the Program's work and
- An economic analysis of the costs and benefits of the Program.

The main focus of the research into the process of change has been on explaining and understanding why the changes observed have taken place, and so the research has been qualitative, not quantitative, in nature. This depth of understanding has also fed important information into the assumptions made in connection with the calculations of economic efficiency, since economic efficiency is only one of the indicators of the impact of IPM projects. The WLS were conducted by CABI Bioscience and the University of Hannover in collaboration with Program members.

The following publications are available in connection with the WLS:

The following short illustrated leaflets are available in hardcopy:

- Different families: different IPM
- Not all extensionists are the same
- Decision-makers: a factor in the change to IPM
- Economic cost-effectiveness: an important criterion in IPM

The following longer documents are also available in electronic form by e-mail:

- Social diversity and differentiated impacts on stakeholders of CATIE IPM/AF (NORAD) Program
- An economic cost benefit analysis of CATIE IPM/AF (NORAD) Program.

To obtain copies of these please contact

CABI Bioscience (glopez@cabi.org) or

CATIE (catienic@mipafcatie.org.ni)

A version of the economic cost-benefit study will also be available in English, as a Pesticide Policy Project publication, from the University of Hannover. (contact: waibel@ifgb.uni-hannover.de)