EASYPol
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ANALYTICAL TOOLS

Module 039

WinDASI Software for Cost-Benefit Analysis of Investment Projects

A Case Study on Crop Intensification and Coffee Plantation

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WinDASI Software for Cost-Benefit Analysis of Investment Projects

A Case Study on Crop Intensification and Coffee Plantation

by

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for the

Food and Agriculture Organization of the United Nations, FAO

About EASYPol
EASYPol is a an on-line, interactive multilingual repository of downloadable resource materials for capacity development in policy making for food, agriculture and rural development. The EASYPol home page is available at: ***www.fao.org/tc/easypol***. EASYPol has been developed and is maintained by the Agricultural Policy Support Service, FAO.

Acknowledgements

This module draws upon the TCAS publication: WinDASI User Manual, Training Materials for Agricultural Planning, 43 FAO - Rome 2000, whose main contributors are Carlo Cappi, who is also the main designer of the computer software, and Lorenzo Giovanni Bellù. The author would like to acknowledge with thanks the contribution of Francesca Petrina, who volunteered for reviewing the first draft of this module and to all the others who contributed in different ways to this final version. The WinDASI software was developed by Laurent Cazalet and Gilles Cappella under the supervision of Mahmoud Allaya at the "Institut Agonomique Méditerraneén de Montpellier (IAM-M)-France.

Table of contents

1 SUMMARY

This module presents a case study in Cost-Benefit Analysis (CBA) of an investment project. It is useful for people who wish to improve their skills in financial and economic analysis and it is particularly suitable as a practical application of the FAO software for Cost-Benefit Analysis "WinDASI". The exercise consists of a brief description of the project, a guideline for the structuring of project data and of an appendix with the project data.

2 INTRODUCTION

Objectives

The main objective of this module is to enable the user to analyze a real case project (although simplified), starting with row data. Due to the fact that this exercise puts the user in a situation somehow similar to the reality faced by Cost-Benefit Analyst, it can be used in a training course, where there is no possibility to organize field visits to gather data for a practical applications of the WinDASI software.

Target audience

This module targets current or future practitioners in Cost-Benefit Analysis (CBA) of investment projects, working in public administrations, in NGO's, professional organizations or consulting firms. Also academics can find this material useful to support their courses in CBA and development economics. Furthermore, students can use this material to improve their skills in CBA and complement their curricula.

Required background

To fully understand the content of this module the user must be familiar with:

- Concepts of project cycle management
- Concepts of project financial analysis
- Concept of project economic analysis

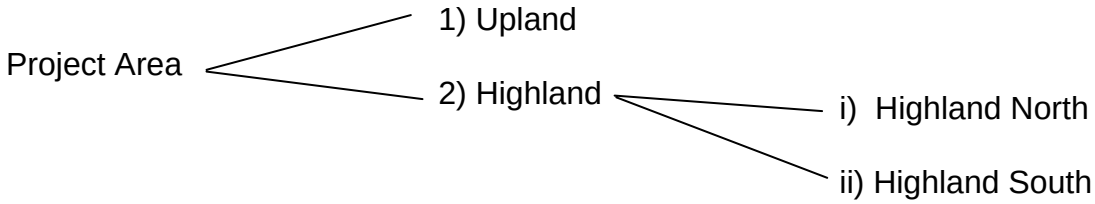
Selected EASYPol modules can be used to strengthen the background of the reader and to further expand its knowledge about investment projects and cost-benefit analysis. Links with relevant EASYPol modules, further readings and references are reported both in the text and in the last section of the module[1].

[1] EASYPol hyperlinks are shown in blue, as follows:
a) training paths are shown in **underlined bold font**;
b) other EASYPol modules or complementary EASYPol materials are in ***bold underlined italics***;
c) links to the glossary are in **bold**; and
d) external links are in *italics*.

3 BACKGROUND

This Case Study illustrates the use of the WinDASI computer program in the analysis of a rural development project.

The project is situated in a certain hilly region of Thailand. The project area has been divided into the following sub-areas because of its physical characteristics:



At present, the farmers in the project area are growing maize and rain fed rice. By participating in the project, the farmers are expected to increase their cropping intensity and their yield by introducing irrigated rice and using more fertilizer. In addition, new coffee plantations will be introduced on Highland farms.

The number of farms expected to be included in the project is about 19,900. Of these, 16,000 are located in the Upland sub-area and about 3,900 farms are located in the Highland sub-area.

Most of the investments are made at sub-area or project level. These are:

- extension services for the whole project area;
- development costs for each of the two sub-areas;
- costs for road improvement in the Upland sub-area.

A large part of the production of maize and rice has always been for home consumption, and this will continue with the introduction of the project.

4 QUESTION SET

Given the project data provided in the Annex, the project analyst is asked to prepare a report on the financial and economic feasibility of the project and, in particular, to answer to questions such as:

4.1 Farm models

(i) Once the project is implemented, is there a need for hired labour for each type of farm?

(ii) What is the volume of production of the major crops grown?

(iii) What is the consumption of fertilizers?

(iv) What is the cash flow? And is there a credit requirement for each type of farmer?

4.2 At project level

(v) What are the results of the economic analysis of the project area and of the two sub-areas (Upland and Highland)?

5 HOW TO USE WINDASI FOR THE ANALYSIS OF THE PROJECT

5.1 Step 1: Organization of the data into the form required by the WinDASI program

The analysis using WinDASI requires that the data given in the annex be organized in a very specific way, namely Commodities, Investments, Activities, Plans, Zones and Project. The fact that project data has to be rigorously defined is an advantage, since it brings clarity to a situation which is often confused and characterized by some important data missing, by the existence of excess contradictory data and unspecified hypothesis.

(i) Identification of Commodities

The user has to ensure that all commodities produced and consumed at each level of the project are included. Each commodity must have a financial and economic price. The table that follows can be helpful in this process:

The total labour requirements both hired and of the household, are valued at their opportunity cost, assumed to be equal to the market price for labour.

Box A

Questions	Answers	Source of data
What is produced in the project area?	▪ Rice ▪ Maize ▪ Coffee	Table 1
There is any home-consumed commodity?[2]	▪ Rice ▪ Maize	Table 5
What are the inputs required?	▪ Rice seeds ▪ Maize seeds ▪ Coffee seedlings ▪ Ammonium Sulphate ▪ 15.15.15 Fertilizer ▪ Labour by month	Table 1 Table 2
Any overhead costs or taxes?	▪ Other costs ▪ Taxes	Table 6
Other costs or benefits?	▪ Development costs[3] ▪ Extension services ▪ Costs for Road improvements ▪ Benefits from road improvements[4]	Table 8 & 9

(ii) Identification of Activities

A separate activity has to be defined for each of the crops cultivated in the project. In addition, since the costs of the project have been included as commodities rather than investments, we define a Development activity of the Upland area.

Box B

Questions	Answers	Source of data
Which are the crop activities?	▪ Rain fed rice ▪ Irrigated rice ▪ Maize ▪ Coffee	Table 2 & 3
Other activities?	▪ Upland development	Table 8

Two activities are identified for the cultivation of paddy, since two different technologies are used with different inputs and outputs per unit of land. The inputs and outputs of each year of the "Coffee activity" will be according the age of plantation of the coffee plants.

[2] The home-consumption information is used for the calculation of the market sales and for the farm cash flows.

[3] Development costs, extension services and road improvements have been included in the Commodities and not in the Investments, since none of the investment parameters have been given (life duration, maintenance costs, scrap value, etc.).

[4] These benefits refer to benefits that other sectors (i.e. trade, handicraft) in the region get from the improvement of the roads made in the project area.

(iii) Identification of Plans

We now define a plan for each farm model of the project.

Box C

Questions	Answers	Source of data
Which are the farm models?	▪ Upland farms ▪ Highland North farms ▪ Highland South farms	Table 3 & 4
Other plans?	▪ Road Construction and Development of Uplands ▪ Development of Highlands ▪ Project Extension services	Table 8

The plan of each farm model will contain taxes and general costs as commodities in addition to the activities related to the crops cultivated in each farm.

The Highland farms introduce the cultivation of coffee. For this reason we include in each of the two farm plans the activity of cultivating coffee. This activity will be included using the "phasing mode", which means putting a "C" under the "Mode" column and specifying a figure representing the new area planted to this activity in every year that new planting takes place.

The plans concerning the development of Highlands and Uplands, as well as the plan for the extension service of the project, will contain only Commodities (no Activity or Investment).

(iv) Identification of Zones

We need to define two Zones to aggregate the various farm models and related development costs.

Box D

Questions	Answers	Source of data
Which are two sub-areas (Zones) of the project?	▪ Upland Zone ▪ Highland Zone	Table 7& 8
Which are the components of Upland Zone?	▪ Upland farm Plan ▪ Upland development Plan	
Which are the components of Highland Zone?	▪ Highland North farms ▪ Highland South farms ▪ Highland development Plan	

In addition we will need a Zone containing the extension service for the project.

(v) Identification of the Project Components

The project will include the two Zones, as identified above, as well as the Zone for the general development cost of the project (extension services).

5.2 Step 2: Farm model analysis

For each of the three farm models that we have defined, we compute the physical quantities of the inputs required, including labour, as well as the total quantity of crops produced.

Concerning labour demand, we need to verify that the labour demanded by the plan that we are proposing is feasible with the labour availability on the farm. The analysis is carried out by comparing labour requirement and labour availability month by month. The difference between labour requirement and labour availability is the need for hired labour of each farm.

Then we proceed to the identification of the costs and benefits for the three farm models and to the calculation of the cash flow of the farms participating in the project.

It will be important to quantify the Net Benefits that each type of farm is going to get from the project, keeping in mind that the only investment required to the farms concerns the coffee plantation made on the farm.

Using the costs and benefits of each farm, it will be interesting to compute the Returns to labour and to land and compare these returns with those of the without project (WoP) situation.

5.3 Step 3: Project indicators and risk analysis of Upland, Highlands and the project

At this point we need to aggregate costs and benefits under large categories in order to be able to conduct a meaningful risk analysis.

The guiding principle in making aggregates is to assemble all costs and benefits of the project in about five or six categories, possibly in the same order of magnitude. The aggregates are then defined through the “Aggregate” component. Once this has been completed we proceed for each Zone and for the Project to the calculation of “Net Present Value”.

Project indicators will be computed for each zone and for the full project using economic prices. Prices will be adjusted, taxes will not be considered and all the labour will be costed at its opportunity cost while paying attention to avoid double counting.[5]

[5] The total labour used in the project is given by the monthly labour requirements. This demand of labour is met by the family labour and hired labour.

For each commodity and investment price, one needs to specify its economic price, if different from the financial price (see Table 55).
In Table 64 some major indicators are reported for each farm model and for the project.

6 READERS' NOTES

The exercise can be fruitfully used in a training course, where there is no possibility to organize a field visit to gather data for the application of WinDASI to a practical situation.

The WinDASI software can be downloaded at: ***www.fao.org/tc/easypol***

Supporting training material is available for this case study. In particular a WinDASI file: THAI.WDS with data already loaded is available in the folder EXEDISK, downloadable from EASYPol, together with the WinDASI software. In addition, in the same folder, the user will find the file THAI.XLS, reporting the results of the calculations of flows of costs and benefits.

The trainer might ask the participants to work in groups and to produce a small report on the financial and economic analysis of the project. The report could then be discussed in a plenary session.

6.1 EASYPol links

This module belongs to a set of EASYPol modules which illustrate how to use the WinDASI application for financial and economic analysis of projects. Before starting with the material presented in this module, the user should have notions on how to handle WinDASI. To this end, he is referred to the following EASYPol modules:

- EASYPol Module 018: ***WinDASI: A Software for Cost-Benefit Analysis of Investment Projects: Installation Note***
- EASYPol Module 019: ***WinDASI-A Software for Cost-Benefit Analysis of Investment Projects: Inserting and Managing Data***
- EASYPol Module 020: ***WinDASI-A Software for Cost-Benefit Analysis of Investment Projects: Calculations Performed by the Software***
- EASYPol Module 021: ***WinDASI Exercise: NGAMO1: An Irrigation Project: Impacts of Irrigation on Traditional Farms***
- EASYPol Module 022: ***WinDASI Exercise: NGAMO2: An Irrigation Project. Impacts of Irrigation and Mechanization on Traditional Farms***
- EASYPol Module 023: ***WinDASI Exercise: NGAMO3: Economic Impacts of an Irrigation and Mechanization Project***
- EASYPol Module 024: ***WinDASI Exercise: NGAMO4: Starting a Coffee Plantation in a Phased Mode***

7 ANNEXES – PROJECT DATA TABLES

General information[6]

General Project Information

Country	:	Thailand
Project	:	Rural Development
Currency	:	Baht
Land Unit	:	Ha
Project Life Span	:	10 years
Crops grown in project area	:	Rain fed rice
	:	Irrigated rice
	:	Rain fed maize
	:	Coffee
Farm models considered	:	Upland farm
	:	North Highland farm
	:	South Highland farm
Project zones	:	Upland
	:	Highland

[6] Adapted from data prepared for a training workshop by the World Bank.

Table 1: Price Assumptions

	Economic Prices in Baht	Financial Prices in Baht
Rice (Ton)	3 000	2 000
Rice seeds (Ton)	3 000	2 200
Maize (Ton)	1 950	1 500
Maize seeds (Ton)	2 145	1 650
Coffee (Ton)	40 000	42 000
Coffee seedlings (Unit)	2	0
Ammonium sulphate (Ton)	4 000	3 200
15-15-15 fertilizer (Ton)	6 000	4 500
Family labour (Man/day)	12	0
Hired labour (Man/day)[7]		
January	18	18
February	18	18
March	19	19
April	22	22
May	22	22
June	22	22
July	16	16
August	15	15
September	14	14
October	15	15
November	16	16
December	17	17

[7] It is assumed that the seasonal wage rate for unskilled labour is the same in financial as well as in economic analysis:

Table 2: Labour Requirements and Availability

Monthly Labour Requirements
(All years)

	Rain fed rice	Irrigated rice (Man/day/ha)	Maize
January	0	0	4
February	0	0	0
March	0	0	0
April	11	0	34
May	20	52	25
June	15	20	15
July	18	18	28
August	18	12	32
September	18	13	11
October	0	0	3
November	20	28	0
December	16	17	0

Monthly Labour Requirements: Coffee

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
January	3	0	6	10	15	26
February	3	40	0	0	0	0
March	0	0	0	0	0	0
April	0	0	0	0	0	0
May	75	0	0	0	0	0
June	46	0	20	20	20	20
July	5	50	30	30	30	30
August	5	0	2	10	20	20
September	3	0	4	4	4	4
October	3	0	12	12	12	12
November	3	20	12	16	18	24
December	3	20	18	34	43	50

On all farms an average of 75 man/day per month of family labour is available for work. Excess family labour, if any is not used (no rent out of labour).

Table 3: Crop Data

Production and Input Requirements

	Unit	WoP[8]	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7-10
Rain fed rice									
▪ Yield[9]	ton/ha	1.20	1.50	1.70	1.80	– – – – – – – – – – – – – – – – – – – –			
▪ Seeds	kg/ha	50.00	– –						
▪ Ammonium sulphate	kg/ha	70.00	76.70	90.00	– –				
Irrigated rice									
▪ Yield[4]	ton/ha	-	2.00	2.30	2.60	2.70	2.80	– – – – – – – – – – – –	
▪ Seeds	kg/ha	-	50.00	– –					
▪ Ammonium sulphate	kg/ha	-	80.00	87.50	95.00	97.50	100.00	– – – – – – – – – – – –	
Maize									
▪ Yield[4]	ton/ha	1.00	1.20	1.30	– –				
▪ Seeds	kg/ha	15.00	– –						
▪ Ammonium sulphate	kg/ha	60.00	73.30	80.00	– –				
Coffee									
▪ Yield[10]	ton/ha	-	-	-	-	-	0.30	0.50	0.80
▪ Seedlings	N/ha	-	-	1 600	-	-	-	-	-
▪ Fertilizer (15-15-15)	kg/ha	-	-	160	320	500	500	650	800

[8] The without project situation (WoP) is assumed constant over the project life.
[9] Loss and wastage is estimated at about 5% of production and should be deducted from the yield figures.
[10] For coffee, loss is estimated at 3.3%.

Table 4: Cropping pattern

		WoP	Year 1	Year 2	Year 3	Year 4-10
Upland Farm						
Farm size	(ha)	2.0	2.0	2.0	2.0	2.0
Irrigated rice	(ha)	-	0.4	0.8	1.0	1.0
Rain fed rice	(ha)	1.0	0.6	0.2	-	-
Maize	(ha)	1.0	1.0	1.0	1.0	1.0
Highland Farm (North)						
Farm size	(ha)	2.0	2.0	2.0	2.0	2.0
Irrigated rice	(ha)	-	0.5	0.5	1.0	1.0
Rain fed rice	(ha)	1.0	0.5	0.5	-	-
Maize	(ha)	1.0	0.5	0.5	0.5	0.5
Coffee	(ha)	-	0.5	0.5	0.5	0.5
Highland Farm (South)						
Farm size	(ha)	2.5	2.5	2.5	2.5	2.5
Maize	(ha)	1.5	1.0	0.8	0.8	0.8
Rain fed rice	(ha)	1.0	1.0	1.0	1.0	1.0
Coffee	(ha)	-	0.5	0.7	0.7	0.7

Table 5: Home Consumption Requirements

Rice	170kg per person per year
Maize	15 kg per person per year

Table 6: Household and Farm Data

	WoP	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7-10
Upland Farm								
▪ Average family size	6.3	– – – – – – – – – – – – – – – –						
▪ Overhead costs[11]	100	100	– – – – – – – – – – – – – – – –					
▪ Taxes	60	67	– – – – – – – – – – – – – – – –					
Highland Farm (North)								
▪ Average family size	6.0	– – – – – – – – – – – – – – – –						
▪ Overhead costs[6]	100	100	200	200	200	300	300	350
▪ Taxes	60	67	– – – – – – – – – – – – – – – –					
Highland Farm (South)								
▪ Average family size	6.0	– – – – – – – – – – – – – – – –						
▪ Overhead costs[6]	100	100	200	200	200	300	350	400
▪ Taxes	60	68	– – – – – – – – – – – – – – – –					

Table 7: Number of Farms in the Project

	Farmers participating in the project
Upland Component	
Upland farm	16 000
Highland Component	
Highland farm (North)	3 000
Highland farm (South)	900

[11] Costs for hand tools, tractor rental and small farm implements.

Table 8: Project Costs and Benefits at Sub-Area Level

	i) Upland component			ii) Highland
	Development costs	Minor roads improvement costs	Benefits from minor roads improvement	Component development costs
	($ millions)	($ millions)	($ millions)	($ millions)
Year 1	21.70	32.60	0	22.60
Year 2	27.25	20.20	0	14.33
Year 3	24.60	14.00	1.24	13.70
Year 4	23.80	15.70	3.74	9.40
Year 5	14.50	16.10	6.22	9.40
Year 6	2.80	1.75	9.30	9.40
Year 7-10	2.80	0.84	12.40	9.40

Table 9: Costs at Project Level

Cost of Extension Services for Project ($ millions)	
Year 1	10.00
Year 2	12.00
Year 3	15.00
Year 4	13.00
Year 5	3.00
Year 6	3.00
Year 7-10	3.00

Table 10: Financial and economic indicators of farm models, the project and its components

	Present Values			Benefit/Cost ratio	IRR
	Benefits	Costs	NPV		
Financial Analysis[12]					
Highland					
North Farm model	44.4	4.4	40.0	10.0	....
South Farm model	46.0	5.4	40.6	8.5	....
Upland					
Upland farm model	16.3	3.0	13.2	5.4	...
Economic analysis[13]					
Highland	188.	112.	76.	1.68	33.4
Upland	414.	227.	187.	1.82	67.5
Project	602.	384.	218.	1.57	39.1

[12] Benefits, Costs and Present Values are in thousands of Baht.
[13] Benefits, Costs and Present Values are in millions of Baht.

Module metadata

1. EASYPol module	039
2. Title in original language	
English	WinDASI Software for Cost-Benefit Analysis of investment projects
French	
Spanish	
Other language	
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English	A Case Study on Crop Intensification and Coffee Plantation
French	
Spanish	
Other language	

4. Summary

This module presents a case study in Cost-Benefit Analysis (CBA) of an investment project. It is useful for people who wish to improve their skills in financial and economic analysis and it is particularly suitable as a practical application of the FAO software for Cost-Benefit Analysis "WinDASI". The exercise consists of a brief description of the project, a guideline for the structuring of project data and of an appendix with the project data.

5. Date

November 2005

6. Author(s)

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7. Module type

- ☐ Thematic overview
- ☐ Conceptual and technical materials
- ☒ Analytical tools
- ☐ Applied materials
- ☐ Complementary resources

8. Topic covered by the module

- ☐ Agriculture in the macroeconomic context
- ☐ Agricultural and sub-sectoral policies
- ☐ Agro-industry and food chain policies
- ☐ Environment and sustainability
- ☐ Institutional and organizational development
- ☒ Investment planning and policies
- ☐ Poverty and food security
- ☐ Regional integration and international trade
- ☐ Rural Development

9. Subtopics covered by the module

10. Training path

Investment planning for rural development

11. Keywords