IFAD'S INTERNAL GUIDELINES

Economic and Financial Analysis of rural investment projects

Minimum requirements and practical examples

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IFAD

Investing in rural people

Acknowledgements

These guidelines have been developed by Eloisa de Villalobos (senior economist, OPR) and Enrico Mazzoli (economist, IFAD).

Building on well-known manuals and on practical cases, they review key topics to highlight the central role economic and financial analysis can play in results-based management and evidence-based decision-making.

Designed as step-by-step guidelines, they provide a sound explanation of what should be expected from a basic cost-benefit analysis of an agriculture project, developing models in Excel and referring to the use of software such as the new versions of FARMOD and COSTAB, for readers who are willing to work on the examples provided along with this manual.

These guidelines are the product of an intensive process of consultation with colleagues both inside and outside IFAD. The authors had the privilege of receiving comments from Gordon Temple, Jock Anderson, Pedro Belli, Amnon Golan and Osvaldo Feinstein, all former World Bank Senior Economists and renowned experts in this field. A draft of this manual was also shared with the FAO-TCI Economists Group, who provided valuable feedback and suggestions. The authors are particularly grateful to senior economist consultants Jorge Piña and Ruy de Villalobos for their inputs, comments and constant support.

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
BAU	Business as usual
BCR	Benefit-cost ratio
BP	Border price
BTS	Before taxes and subsidies
CBA	Cost-benefit analysis
CEA	Cost-effectiveness analysis
CF	Conversion factor
C.i.f.	Cost, insurance and freight
CPM	Country Programme Manager
EFA	Economic and financial analysis
EIRR	Economic internal rate of return
ENPV	Economic net present value
EPP	Export parity price
FDR	Financial discount rate
FIRR	Financial internal rate of return
FNPV	Financial net present value
F.o.b.	Free on board
IFI	International financial institution
IGs	Internal guidelines
IPP	Import parity price
IRR	Internal rate of return
LCU	Local currency unit
M&E	Monitoring and evaluation
MTR	Midterm review
NB	Net benefit
NIB	Net incremental benefit
NPV	Net present value
OER	Official exchange rate
PCR	Project completion report

PDR	Project design report
PTA	Policy and Technical Advisory Division
PV	Present value
QA	Quality assurance
QE	Quality enhancement
SA	Sensitivity analysis
SCF	Standard conversion factor
SDR	Social discount rate
SER	Shadow exchange rate
SERF	Shadow exchange rate factor
SWR	Shadow wage rate
SWRF	Shadow wage rate factor
SV	Switching value
VAT	Value-added tax
WOP	Without project
WP	With project

SECTION I

Economic and financial analysis

Introduction

Background and relevance

Since 2008, when IFAD established its quality enhancement (QE) process, project reviewers at both the QE and quality assurance (QA) stages have identified areas of weakness in IFAD's use of economic and financial analysis (EFA) in project design. Specific areas of concern range from technical considerations about the quality of the analyses and data (poor assumptions, use of shadow pricing and discount rates) to broader issues regarding the use of EFA as a tool in project design (activity selection, logical framework [LogFrame] design and risk analysis).

The Policy and Technical Advisory Division (PTA) has taken several steps to assist country programme managers (CPMs), mission leaders and EFA analysts to improve the quality and relevance of EFA at project design and implementation. As a first step, in October 2011 PTA organized a workshop with expert practitioners to establish a consensus regarding internationally accepted standards and best practices. Here the suggestion was made to develop internal guidelines (IGs) to define the minimum requirements for a rigorous EFA. Since 2012, a set of standard requirements for EFA in project design has been in place, in line with IFAD's commitments in its founding documents (see the Agreement Establishing IFAD,[1] and the IFAD Lending Policies and Criteria[2]), as well as responding to commitments from IFAD10,[3] in which one of the indicators of the corporate Results Measurement Framework is to ensure that loan-financed projects receive a published and verifiable economic analysis.[4]

How to read these guidelines

These IGs are divided into three volumes. **Volume 1** highlights the relevance of EFA for investment projects in general, presenting some basic technical concepts and briefly describing the process of classic EFA. It also explains the use of different EFA elements throughout the design, implementation and supervision of development projects. A short presentation of alternative methods to cost-benefit analysis (CBA), such as cost-effectiveness analysis (CEA) and multicriteria analysis, is also included. **Volume 2**, the core of these IGs, defines minimum requirements for the elaboration of a comprehensive EFA of IFAD's rural investment projects. All detailed steps of the analysis are presented and illustrated through a hypothetical example, the *Guideland Rural Development Project*. The annexes to volume 2 offers technical notes, practical tips, quality checklists and suggested tables for the presentation of results. **Volume 3** presents a set of practical examples on the assessment of quantitative benefits for cases in which project activities are not directly related to production or productivity objectives (e.g., rural finance projects, climate adaptation initiatives, and community-demand-driven or capacity-building projects).

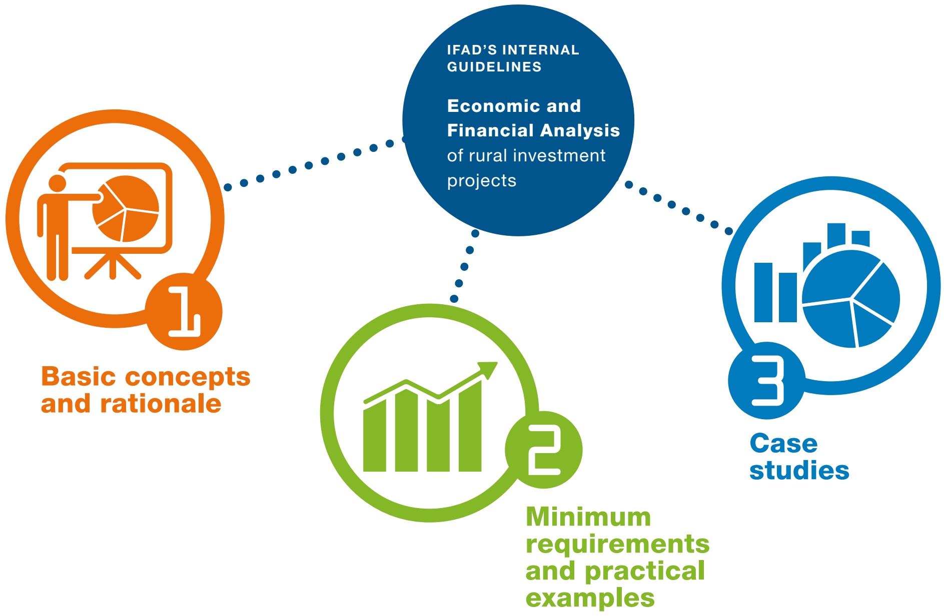
1 Article 7, section I[d] "… eligibility for assistance shall be on the basis of objective economic and social criteria…".

2 [III (26)] "The Fund, taking due account of … the principle of economic viability of projects…".

3 The Tenth Replenishment of IFAD's Resources.

4 Indicator 4.2.7: "share of projects with a published and verifiable economic analysis (yearly)". Revised IFAD10 RMF (2016-2018).

FIGURE 1
EFA guidelines outline



Scope

These IGs are, by definition, an auxiliary methodological tool. They should be considered an open and dynamic document, which will be regularly updated to introduce changes and/or complementary information, responding to the needs of the main users. They do not pretend to substitute for the large bibliography on EFA and CBA developed by academics and other international financial institutions (IFIs), which analysts may consult.[5]

Finally, any project analyst should rely on his/her best judgment, refined through experience, when deciding on the methodology and assumptions to be used. These IGs, like any guidelines, are not a substitute for these essential qualities. It is hoped, however, that they will help reduce the scope for subjective judgment in projects' EFAs, and bring a degree of standardization to the presentation of results.

Purpose of this volume

The main purpose of this second volume is to present in a clear manner IFAD's standards and minimum requirements for the preparation of an EFA for the design of any rural investment project. This volume is addressed to CPMs and EFA analysts (consultants, mission leaders, etc.) who need both to know the requirements and to understand the logic behind this set of standards. By reading this volume, users will be better able to identify (a) key outcome indicators that can be used in the LogFrame; (b) sections of the analysis that provide answers to governments about the efficient allocation of their resources; and (c) how to link identified uncertainties about market and climate risks into the analysis – in brief, how to make better use of the information derived through this analysis at the different stages of the project cycle. Moreover, users will find here simple and hands-on instructions, illustrated by examples of how to apply the minimum

5 See list of references.

requirements, templates to facilitate compliance with required standards, and answers to such common methodological issues as the presentation of key assumptions, the inclusion of externalities, the application of shadow prices, and the definition of a proper discount rate.

Section II provides the list of requirements and the methodological justification from IFAD's perspective, and section III shows a step-by-step example, illustrated through the hypothetical case of the *Guideland Rural Development Project*. The annexes provide additional technical information, templates and checklists for compliance.

Specific requirements for EFA in IFAD

IFAD's focus

The minimum requirements set by these guidelines are not different from what is contained in CBA technical literature. However, IFAD's focus on rural people, and especially on rural poverty, conveys a unique perspective for this analysis compared to that of other IFIs. The main difference relates to the types of questions this analysis intends to answer.

The purpose of CBA is to ensure the efficient allocation of government spending. Thus, CBA[6] is a powerful pre-investment tool currently required by most IFIs – for example, the African Development Bank, Asian Development Bank (ADB), Inter-American Development Bank and World Bank – when deciding on project financing and advising recipient governments accordingly.

Although IFAD's founding documents acknowledge the relevance of economic analysis as a requirement for project approval, efficiency considerations and choices between mutually exclusive projects – all common concerns for other IFIs – are not the core focus of IFAD's operational approach.[7] At IFAD, decisions on whether and where countries' operations will be planned and implemented are made through the Results-based Country Strategic Opportunities Paper (COSOP)[8] exercise. Here, the economic rationale is not the main driver for decision-making, since governments are aiming to reduce poverty and inequalities through IFAD's interventions.

IFAD's operations cover a broad range of activities that experience has shown are strategic in reducing rural poverty. Examples of IFAD's interventions include increasing sustainable access to land, natural resources and inputs; improving the provision of services (extension, financial, market, etc.); and strengthening local capacities and empowering vulnerable groups. The combination of these and other on-farm activities is intended to trigger productivity increases, raising incomes at the farm and household levels and resulting in the reduction of poverty and vulnerability.

It is not a simple task to elaborate a list of minimum requirements for an analysis in which so many aspects depend on the type and context of each individual case. Still, all these activities and interventions are implemented with the main objective of reducing rural poverty: this is the common element in all of IFAD's projects, and the driver behind IFAD's most relevant questions on impact. In addressing such questions, the EFA plays a key role. This analysis can prove to governments that project interventions are viable and that they will improve beneficiaries' situation.[9]

From an IFAD perspective, to reassure governments on the positive effect the project is

6 In the economic technical literature, there is a slight difference between EFA and CBA. The EFA is considered the theoretical approach used in the analysis of economic issues and measurement of economic effects. Such analysis can be carried out through different methods, including CBA and CEA. However, throughout this manual the authors considered EFA and CBA as interchangeable to indicate both the analysis and the method. They could do so as these guidelines are entirely focused on CBA and do not include CEA or other methods.

7 See IFAD Lending Policies and Criteria, I (5): "IFAD will concentrate its resources upon activities that promise to achieve in a cost-effective way a reduction of poverty in rural areas, where most poor people live and work. The Fund's major target groups, irrespective of the stage of economic development of the country, will be the small and landless farmers".

8 The COSOP is a framework for making strategic choices about IFAD operations in a country. The document reviews the specific rural poverty situation as the basis for determining geographic sites and related thematic areas where IFAD would operate and highlights the innovations it intends to promote in the country programme.

9 As IFAD's main target is poor rural families, people are usually living under the poverty line. Based on the incremental approach used in the CBA, NPV > 0 ensures that the project proposal is viable and better than the business-as-usual (BAU) or present situation.

FIGURE 2
EFA guiding questions

having on rural poverty, we need to strengthen and clearly demonstrate the links between actions and achievements at the farm level and their social impact on a broader scale. Thus, to ensure the success of a project – that is, the uptake of the proposed interventions, and hence the global impact on poverty reduction – the following aspects of any project design should be considered and assessed: (a) the viability of the project as a whole, from the government's perspective; (b) the project's feasibility, from the farmer's point of view; and (c) the risks perceived by each agent involved in the project so as to address them in the project design (see figure 2).

Nine steps for EFA

As has been stated, the minimum requirements set by these guidelines are in line with classic CBA.

The evaluation period for the financial and economic analysis should be 20 years. Use of a different period – because of the nature and lifetime of the investments – should be specifically justified. The EFA requires nine steps (see box 1) – the necessary elements to ensure both the convenience of private investments for target beneficiaries, and the efficient allocation of public resources by governments.

These nine steps help ensure that the analysis provides sufficient information on two key aspects of IFAD's interventions:

- Reaching people in rural areas and engaging them in new agricultural practices is a crucial achievement for IFAD projects and a first step for a sustainable impact. Therefore, IFAD requires a very detailed analysis at the farm level, where different types of households and livelihoods need to be considered and assessed. This analysis implies calculating activity-/farm-based cash flows and incremental benefits in financial terms, and identifying their specific financing needs.
- A second key requirement is to use the financial analysis as the base for the economic analysis.[10] In this way, once the viability of proposed activities at the farm and enterprise level is ensured, consideration of a project's impacts on the economy as a whole can be assessed.

10 This approach is highly recommended for IFAD's projects, as their priority is to increase rural populations' welfare and incomes by improving agricultural practices and productivity. However, when project goals have a different focus than increasing productivity (for example, improving nutrition or preserving biodiversity), alternative approaches may be used and the economic value of the project may be measured based on different parameters (such as disability-adjusted life years, greenhouse emissions (CO2), etc.). Nonetheless, these approaches need to be very well justified and based on sound and well-documented methodologies. Practical examples on the matter are presented in IFAD's EFA Guidelines (2016) Vol. III.

BOX 1

Steps for a sound EFA

Financial analysis – 4 steps

1. Develop farm/enterprise models and identify benefits and costs (both investment and recurrent) for with- and without-project (WP and WOP) scenarios (based on crop budgets).
2. Compare the discounted flows of benefits and costs and calculate the differences between the results obtained and the WOP scenario to determine the net incremental benefits (NIBs) of the proposed interventions.
3. Calculate the project financial profitability indicators of each model – financial net present value (FNPV), financial internal rate of return (FIRR), return to family labour and benefit-cost ratio (BCR) – and apply these investment criteria to make an investment decision (positive or negative).
4. Assess family incomes and establish financing/credit needs by performing a sustainability analysis.

Economic analysis – 5 steps

5. Convert all market prices to economic prices that better reflect the social opportunity cost of the good and remove transfer payments (taxes and subsidies).
6. Quantify externalities (positive and negative).
7. Describe phasing patterns for beneficiaries' incorporation into project activities and aggregate farm/enterprise net incremental benefit cash flows.
8. Compare aggregated incremental benefits with economic project costs and discount final project cash flow, adopting a social discount rate to calculate economic performance indicators: economic net present value (ENPV), economic internal rate of return (EIRR) and BCR.
9. Perform sensitivity analysis to deal with the main risks and uncertainties that could affect the proposed project.

The financial vs. the economic perspective

How can a CBA ensure that the private and public dimensions are included and combined into the analysis? The financial and the economic analysis are elaborated from two different perspectives; the former has a private-agent perspective and the latter a broader social perspective. Investment decisions are driven by each agent's perspective. For example, the opportunity costs and the risks of the investment that each agent considers when assessing alternative investments are different. Also, the period considered as acceptable for the generation of returns for the investment differs. IFAD requires that these differences be taken into account at all levels of the analysis.

To illustrate how relevant this requirement is, let's consider that private agents normally assign more value to present consumption than future consumption. In other words, in allocating their own resources they focus more on the short term than does the public agent (government). In addition, private agents have limited knowledge of the market and allocate a higher opportunity cost to their own investments. The government, however, pursues more long-term objectives (such as reduction of inequalities, preservation/regeneration of natural resources, etc.) and therefore assigns less value to present returns.

Therefore, each agent perceives differently the cost of forgoing present consumption in favour of future revenues (the definition of opportunity cost). This perception influences the decisions on discount rates (used to reflect opportunity costs) to be applied when calculating profitability indicators. Hence, discount rates should be different in the financial and the economic analysis. IFAD requires the use of a social discount rate (SDR) when calculating economic project indicators[11] and a market discount rate when calculating financial profitability indicators.

11 To discount economic cash flows into present values to calculate ENPV, EIRR, economic BCR and so on.

Each agent also perceives project costs and benefits differently. For example, while the government may be concerned about the long-term implication of natural resources depletion and increased pollution, the private agent (i.e., the farmer) has little or no interest in taking into account all negative or positive impacts that his/her actions may have on the rest of society. At the same time, the private agent acts in a market where the values of inputs and outputs are affected by taxes and trade barriers imposed by governments – to protect certain industries or reduce unemployment – which in turn distort the real opportunity value of those goods and services for the society as a whole.

Ideally, free and fully functioning markets should automatically lead to an efficient allocation of values among commodities[12] so that economic values are equal to market values, but this is not the case in the real world. Therefore, when building the economic analysis from models developed during the financial analysis, these differences need to be reconciled, ensuring comparability across the value of all of the project's inputs and outputs. This requirement implies the calculation of proper shadow prices[13] for all – or at least the most relevant – project inputs, outputs and exchange rates.

12 According to neoclassical economic theory.

13 For a clearer exposition of the topic, the authors considered shadow prices and economic prices interchangeably, even though there is a slight difference in the definition of the two based on the calculation method adopted. Shadow prices result from the optimization of a Lagrangian objective function, where the estimate parameters maximizing (or minimizing) the function are considered the shadow prices. Economic prices result from a less sophisticated calculation method that compensates for internal inefficiencies to calculate the efficiency prices (also known as economic prices or accounting prices).

SECTION II

Financial analysis

This section explains how the financial analysis assesses the project from a private perspective, which elements need to be considered and how they are valued.

At this stage of the analysis, it is key to remember that because private agents are not a homogeneous group, different models need to be developed to represent them all, or at least the majority of them. The financial analysis assesses the attractiveness of the project for these target groups, comparing proposed interventions with their current situation. Thus, a crucial aspect at this stage is the representation of the business-as-usual (BAU) situation and the assessment of the value-added and positive productive changes the project will bring to the individual beneficiary – also known as the incremental value of the project. The cash flow analysis carried out at this stage assesses the profitability of the investments for the producer/individual viewpoint and, at the same time, will be the starting point for the subsequent economic analysis.

During these first steps of the EFA, the focus is on the financial performance of productive units (farms and businesses) run by project beneficiaries. The analysis will answer questions such as the following:

- Is this the best agricultural practice for the project-specific context?
- Are projects' improved practices financially viable?
- Is this a better solution than the actual/present practice?
- Are the new technologies and inputs required affordable and available?
- Are investment costs affordable and sustainable, or do they need to be covered by the project?
- Will farmers be able to implement new practices without project subsidies?

To reply to these and other relevant questions, the financial analysis should be based on accurate and detailed representations of beneficiaries' current common agricultural practices and proposed solutions.

Let's then start with defining and developing the very first elements of the analysis.

The recommended tool for the description of beneficiaries' production functions is the formulation of *farm models*. The analysis develops a number of models that represent the production systems/innovations introduced to the target population.[14] The farm models replicate current production practices, which are then compared with project proposals to assess their viability. Farmers' production systems (i.e., the size of their plots, the distributions of crops and livestock, and the composition of their household) are reproduced by using *crop models*[15] as the primary building blocks for farm models.

Crop models and farm models are composed of two important parts: (a) the technical and physical description of the activity; and (b) the financial budget, which presents cash inflows and outflows (i.e., crop budget). The technical and physical

14 As a matter of fact, the optimal tool should be "rural household models" in which, in addition to data related to the productive conditions, other items may be included such as off-farm incomes and in-kind exchanges.

15 Crop models and activity models (used for livestock and/or other production activities) are technical parameters usually prepared for one unit of area (ha, acre, etc.) by national agricultural research institutions. When this information is not available, the project mission agronomist must gather "in situ" data to prepare it. Farm models are built upon this information: usually, the farm models differ by the size of holdings and/or by different agro-ecological and productive situations.

description is important to justify the choice of technical parameters and analyse the physical performance (e.g., input-to-output conversion), while the financial budget assesses the viability of the investment in financial terms (i.e., revenues as opposed to costs). In other words, the first part provides the quantities of inputs and outputs required and generated by the model; and the second part values them by their market price. All costs and revenues should be valued at constant market prices in domestic currency to ensure that project outcomes are not affected by inflation.[16]

Crop models

The technical parameters necessary to develop these models are generally provided by the government's extension agencies or by the agronomist of the mission. This information is also generally collected during field visits while interviewing farmers about current practices and production constraints.

During the elaboration of crop models, current production techniques are analysed and compared with at least one alternative option, based on criteria such as the following: (a) NPV or IRR; (b) market projections; (c) local availability of inputs; (d) production and technical risks; (e) burden on family labour (days/year); and (f) family labour return ($/day). The experts should compare alternatives and choose the best option to be used as WP situations for the project. This process is an iterative process of trial and error that also considers aspects of sustainability, as will be seen in the next sections.

When developing the WOP scenario, it is important to avoid confusion between "present situation" and "without-project situation". The WOP situation is a forecast of the present situation and could include scenarios such as (a) a gradual improvement of present conditions because of expected positive elements (e.g., positive evolution of prices., gradual adoption of better technologies); (b) the maintenance of present productive conditions in the future; and (c) the worsening of present productive conditions because of expected negative elements (e.g., gradual loss of soil fertility and yields, price decreases for present crop varieties).

The WP situation describes required inputs as well as outputs generated by the new agricultural practices, first in physical and then in financial terms, using the same types of analytical tools as the WOP. The clear presentation of this information is essential to understand the "expected benefits" generated by the project.

Farm models

Once the basic technical and financial information has been collected, the analyst should identify the different sizes of farms and the uses of land in the project area to prepare representative farm models to illustrate the present and the WOP situations. Any additional information about farm systems – off-farm activities, size of household, number of working members, remittances, etc. – improves this step of the analysis and increases the reliability of the model.

Once the farm models have been developed, the agronomist and other experts use them to agree on the formulation of the best technical proposal to build up the WP scenario.

Specific aspects requiring a detailed analysis at this stage:

(a) **WOP scenario equal to zero.** When a new crop is introduced or new activities proposed, many analysts present a WOP scenario equal to zero, arguing that there were no activities in place before, and thus no incomes. The results of such models would be overoptimistic in terms of expected benefits, providing a distorted image of the profitability and viability of the new activity. It is true that representing the WOP scenario, when WOP activities are not in place, is challenging. Yet, in poor rural areas, farmers who own lands that are difficult to access or drain always engage in other activities – for instance, working for other farmers or earning off-farm incomes. Therefore, the net profits from alternative activities or, alternatively, the opportunity cost of family labour should be used as a proxy for WOP. The crop model can be developed with a WOP scenario equal to zero if, for example, the activity will be developed in an area that is not in use at the moment; but in the farm models, the WOP situation should realistically reflect how farmers

16 More information and examples of the use of constant prices and the choice of the numeraire are in section IV.

are using their time and resources today in comparison with the project proposal.

(b) **Description of changes in cropping patterns and land use in WOP and WP scenarios.** This may result in a simple description of shifting crops when new technologies will replace the old ones in the next cycle, but agriculture is not always such a simple business. Many crops are not 100 per cent productive from the start and reach their full development only several years after being planted. Thus, the analyst needs to take into consideration the phasing of expected benefits and land-use patterns during the shifting period.

(c) **Labour and input requirements assessment.** The introduction of new agricultural practices is expected to produce yield increases that are generally well documented. However, less attention is given to the incremental requirements in term of inputs, land and labour, which should also be carefully assessed to establish whether the proposed technical solution is viable, in combination with the rest of the farm activities. An excessive demand on family labour requirements should be reflected by an increase in hired labour.

(d) **Aggregation of different production systems.** It is important to be very accurate in describing the phasing of expected changes in yields and production costs when aggregating, as different crops have different input requirements (labour and capital) and growing patterns. Tree planting requires investments and incremental labour for extra pruning and care during the first years when the trees are not producing, which can put farmers in a difficult situation if alternative crops are not compensating for the trees' deficit (see the illustrative example in section IV).

Table 1 summarizes all the steps necessary for the financial analysis, the basic elements required for elaborating the analysis, and the types of questions that could be answered in each step.

In section IV of this guideline, all these steps will be illustrated with a practical example.

TABLE 1

Steps for the financial analysis

FINANCIAL ANALYSIS		
Steps	**Elements**	**Questions**
1. Develop the models with WOP and WP scenarios		
Develop models to represent all possible target groups to assess project technical proposal at the farm and enterprise levels. Identify benefits and costs (investment and recurrent) for WOP and WP scenarios (based on crop budgets).	Prepare: ▶ Crop models (physical parameters) for 1 ha/acre for each crop ▶ Crop budgets (financial parameters) for 1 ha/acre ▶ Activity models/budgets ▶ Farm models and budgets representing existing cropping patterns as well as proposals on intercropping and diversification	Are inputs sufficient to produce expected outputs? Are post-harvest losses being considered? Has the project made any provisions to reduce them? Is self-consumption included? Are farm models phased appropriately?
2. Compare cash flows		
Calculate net benefit (NB) cash flows by subtracting yearly production cost from corresponding production revenues. Calculate net incremental benefit (NIB) cash flows by comparing WOP and WP NB cash flows.	Revenue streams: ▶ Cash flows from production revenues ▶ Post-harvest losses streams ▶ Self-consumption streams ▶ Cash flows from sales revenues Production cost streams: ▶ Investments ▶ Operating inputs ▶ Labour costs: – Hired labour – Family labour	Is the WOP situation well described? Are sales different from production quantities? Are WP expectations realistic? Are all costs needed to achieve production levels included in the models, regardless of who is bearing them? Is family labour quantified and valued?

FINANCIAL ANALYSIS		
Steps	**Elements**	**Questions**
3. Calculate profitability indicators		
Calculate the project's financial profitability indicators for each model. Apply corresponding investment criteria to determine financial viability (positive or negative).	▶ Profitability indicators (FNPV, FIRR and BCR), all calculated on the same NIB cash flow stream.	**Should** the farmer adopt the new production techniques? Do discount rates reflect the local opportunity cost of capital?[17] Is the discount period coherent with the nature and lifetime of the capital invested?
4. Financial sustainability		
Calculate family/household incomes as accurately as possible. Establish financing/credit needs. Assess whether the project proposal is appropriate by performing a sustainability analysis.	▶ *Cash flows* are now developed through a funds flow perspective (liquidity analysis). ▶ The streams of costs and revenues used to calculate NB are slightly different than before. ▶ Family labour is not a production cost (there is no financial transaction). – *Incomes:* sale revenues only (not production revenues). – *Financial needs:* calculate NB before financing. ▶ Specify who pays for what: beneficiaries' cash contribution (own) and project's contributions (grants and subsidies). ▶ Assess if all yearly results are positive, or above BAU. If not, look at alternative financing possibilities. ▶ Credit analysis (based on local conditions).	**Can** the farmers adopt the proposed interventions? Are production inputs available locally? Is family labour sufficient? Is the required labour force available for hire? Can the farmer afford the new proposal? Are the provided subsidies adequate? Farmers need to have a positive income every year to cover family needs and operating costs for the following year. If those costs cannot be covered, the model is financially unsustainable. Are local financial service providers offering suitable products?

17 E.g., passive interest rates of local commercial banks, returns on alternative investments.

SECTION III

Economic analysis

Criteria and steps for economic analysis

General criteria

The next stage is to undertake the economic analysis of the project. This analysis is performed from the perspective of the economy or society as a whole, and is quite different from the perspective of the project beneficiaries – or individual entrepreneur – that was used for the financial analysis. The two main aspects that differentiate economic from financial analysis are (a) the consideration of externalities, and (b) the use of economic prices that reflect the opportunity costs of goods and services for the country – usually different from their financial/market prices.

The following table summarized the steps and elements the specialist needs to consider and calculate in order to perform this analysis:

TABLE 2

Steps for the economic analysis

ECONOMIC ANALYSIS		
Steps	**Elements**	**Questions**
5. Convert financial to economic prices		
Convert all market prices into shadow prices (economic values) using appropriate conversion factors that better reflect the social opportunity costs of each good and service and remove transfer payments (taxes and subsidies).	To calculate shadow prices, some important decisions need to be taken about: ▶ The numeraire ▶ Identify the levels of indirect taxes and remove transfer payments ▶ Conversion factors (CFs) to be calculated. These IGs suggest, as a minimum to consider: foreign exchange, tradable goods, non-tradable goods, labour (wages) and social discount rate (SDR).	Are calculations of economic/shadow prices well justified? Is a proper SER calculated and applied? Are taxes and duties eliminated?
6. Calculate externalities		
Quantify externalities (positive and negative).	▶ Aggregated NIB from externalities (positive and negative). ▶ Aggregated cash flows of "other" economic benefits (e.g., rural roads, water and sanitation infrastructure) [indirect benefits/beneficiaries].	Are externalities well accounted for? Are minimum efforts being made to include indirect/other benefits?
7. Aggregate NIB from productive activities		
Describe phasing patterns for beneficiaries' incorporation into project activities and aggregate farm/enterprise NIB cash flows.	▶ Aggregated economic cash flows of NIB from all farms and activities involved in the project [direct beneficiaries] using economic prices and eliminating transfer payments. ▶ Based on financial returns of each model and local consultations, set up an adoption rate for each model.	When aggregating projects' overall NIBs, does the phasing respect technical parameters, and is it coherent with assumptions in COSTAB? Will uptake be high?

ECONOMIC ANALYSIS		
Steps	**Elements**	**Questions**
8a. Compare aggregate NIB with economic project costs and discount final project cash flow		
Calculate economic project costs (those not already included in in the farm budgets).	▶ All economic project costs ("other costs") should duly be taken into account (e.g., working capital and in-kind contribution from beneficiaries or other financiers). ▶ Check if spending in COSTAB is in line with activity phasing description. ▶ Make sure all resources transferred to farms via direct transfer; project subsidies (grants) or credits are not included in other costs to avoid double-costing.	Are all incremental costs being considered? In-kind as well as in-cash contributions valuated? Are they all covered by an identified source of finance?
8b. Calculate economic profitability indicators		
Calculate incremental net benefits for the project as a whole. Adopting an SDR, discount this cash flow to calculate economic performance indicators: ENPV, EIRR, BCR.	▶ Compare aggregated incremental benefits (7) with economic project costs (8a) and calculate total project cash flow. ▶ Select an SDR that properly reflects government opportunity cost of capital.	**Should** the government invest in the project? Investment criteria: ENPV > 0 EIRR > SDR BCR > 1
9. Sensitivity analysis		
Perform sensitivity analysis to test the probability and severity of the main risks and uncertainties that could affect the proposed project.	▶ Perform a sensitivity analysis using identified project risks. ▶ Present results to project team and discuss severity of each risk. ▶ Flag parameters that should trigger mitigation measures: e.g., if fertilizers reach *X* price level tomato production will be unfeasible; or if total number of beneficiaries does not reach at least *N* people the project will not be viable.	Are project risks properly assessed? Which variables are the most critical ones and could jeopardize project achievements? Are there any triggers to be flagged?

Selecting the numeraire

The earliest decision the analyst has to make is selecting an appropriate *numeraire* – that is, the unit of account on the basis of which project costs and benefits will be compared with one another and valued. This step is necessary because the monetary prices of goods and services considered in the financial analysis – although they can be compared – are not a straightforward indication of either their real opportunity cost or their actual value to society. Moreover, using a numeraire allows us to assess whether the project is the best and most efficient solution to achieve national objectives.

Costs and benefits are generally expressed in a currency so that they are homogeneous and can be treated algebraically. However, some of these items are traded internationally – and thus are subject to competition – while others, by their nature (e.g., land), are not. Therefore, the value formation process of tradable and non-tradable goods would be ruled by different markets (local or international), functioning under different conditions. Consequently, in the valuation of traded and non-traded goods and services, it is important to level out all discrepancies by bringing all items to a common denominator. In addition, in economic analysis it is important to use a homogeneous denominator that helps reflect the scarcity value of all project resources, irrespective of their nature (tradable or non-tradable) or their place of origin (national or international market). This common denominator is exactly the numeraire of the analysis, which could be set at either the *domestic price level* or the *international (world) price level*. It is important to clarify that the numeraire is the pricing system (domestic or international) used for the valuation of project resources and not the currency (local or foreign) in which project resources are expressed.

The numeraire selected depends on the objectives of the project and on the variable we need to measure to verify whether project objectives are fulfilled. In public investments, the following national objectives are normally pursued through a project: (a) an increase in private consumption, (b) an increase in investment, or (c) an increase in the foreign currency available to the public sector. If we want to measure a change in the national income the project has brought – by looking at increases in consumption, savings or investments – we can register such increments in domestic market price equivalent values or in international market price values. The selection of either of the two systems will not affect the final results, as long as consistency in the calculation is ensured. In other words, the numeraire is the close link, or connection point, between shadow prices and national objectives.[18]

As mentioned earlier, shifting from the financial to the economic analysis brings about a change in the analysis perspective of the project, moving from the private profitability for individual beneficiaries (financial analysis) to the maximization of social welfare (economic analysis). The social dimension of the economic analysis is also reflected in the selection of the numeraire. In fact, an increase in the income of individuals, or an increase in consumption generated by the project, would have a different weight in public rating: an additional dollar to a person is not the same as an additional dollar to another person when the two have different income or wealth levels. Similarly, in a country with scarce foreign currency reserves, a project resulting in an increase of foreign currency held by the government would be worth more than another project depleting foreign reserves, as the former project is better positioned than the latter to help the government pursue its long-term monetary targets. Therefore, from a social perspective, or the government standpoint, dollars invested in national programmes or public investments are not worth the same number of cents. They have a different worth according to how they achieve national primary objectives (e.g., poverty reduction).

When there are no market distortions, or when all distortions are corrected, the *domestic price level* would be characterized by the fact that all prices of non-traded and tradable goods and services are equivalent to their market prices[19] (expressed either in local currency or foreign exchange currency). The *international price level* would be characterized by the fact that all prices of traded and non-traded goods and services are equal to their border prices (expressed either in local currency or foreign exchange currency). Four different combinations of currencies and price levels could be used in the economic analysis of projects.[20] However, the most common approach is to adopt a domestic price level numeraire expressed in local currency.

Financial analysis is usually conducted at prevailing domestic market prices expressed in local currency. If, to better assess project impact for the local economy, the economic analysis is to be integrated into or build upon the financial models, both analyses should be expressed in the same unit of account. For these reasons, these IGs recommend the use of the domestic price level expressed in local currency as numeraire for both the financial and economic analyses.

Calculating economic prices or shadow prices

The next step is to convert the market prices of goods and services into their economic values, also called *shadow prices*. In practical terms, this correction can be done by using information provided by the national planning authority, which normally estimates such prices.

When national authorities do not provide this information, the analyst needs to arrive at appropriate estimates for the shadow (or economic) prices. The first step (a) is to eliminate transfer payments included in market prices (i.e., indirect taxes and subsidies). The next steps take into account five main categories of prices that need to be controlled

18 In these IGs, we adopted a practical approach in defining the numeraire. In reality, the selection of the numeraire is influenced by the medium-/long-term national objectives to be maximized through the project. The unit of account can either be the consumption level (UNIDO approach) or the foreign exchange (OECD approach) held by the government to influence its political economy and monetary policy. The two approaches will in turn be valuated, using domestic or international prices, respectively. A thorough exposition of the subject is provided by Ward et al. (1991).

19 Those used in the financial analysis.

20 More information is provided in the appendix.

for distortions and eventually adjusted: (b) foreign exchange, (c) tradable goods, (d) non-tradable goods, (e) labour (wages), and (f) social discount rate. We summarize the calculation of economic prices under an alternative numeraire in section (g).

a. Transfers

For the economy as a whole, subsidies and taxes are considered transfer payments within the same economy as they do not generate any real value or loss for the economy. For instance, a farmer who pays taxes to the government is certainly worse off, having renounced part of her/his revenues. Simultaneously, a government that effectively collects taxes is better off, as levies increase government budgets. However, in aggregated terms, the whole society, to which both the farmer and the government belong, does not get any richer or poorer after such payments occur – they represent just a transfer of resources between economic agents that are part of the same accounting unit (the society). The same logic, in reverse, applies to subsidies, which are transfer payments from the government to farmers. From an economic or social point of view, this transaction does not generate any value, and thus can be cancelled out from the economic analysis.

Accordingly, all market prices used in the financial analysis – where the analysis is carried out from an individual standpoint – should be corrected by eliminating the effects of any taxes or subsidies in the economic analysis, where the viewpoint is that of the whole society. In practical terms, this implies following these general rules:

- All prices of inputs and outputs used in the project should be net of indirect taxes (e.g., VAT, sales taxes).
- All prices of inputs and outputs should be net of indirect subsidies (e.g., subsidies to the price of energy, subsidies to the price of transportation).

b. The shadow price for the exchange rate

Before estimating the economic prices of project inputs and outputs, the analyst should choose the appropriate foreign exchange rate that will be used to convert international prices into domestic prices (and vice versa). The foreign exchange rate is a commodity like any other good or service involved in the project, and thus its appropriate economic value ought to be estimated. The *shadow exchange rate* (SER) is the foreign exchange rate that reflects – better than the OER – the economic value of the foreign currency in the economy.

Discrepancies between the SER and the OER are generally related to (a) suboptimal trade policies that alter domestic prices of imported/exported goods and services vis-á-vis their border prices in foreign currency; (b) market failure, as when there is a parallel black market for foreign currencies; or (c) policy failures, as in the case of recurrent devaluation of the local currency to promote country exports. Trade policies and regimes such as import duties, quantitative restrictions, export subsidies or taxes distort not only individual prices of goods and services, but also the price of the foreign currency for the economy as a whole. Import tariffs represent an extra cost for the importers in the country and serve to reduce the demand for imported goods by making them more expensive than locally produced goods. Accordingly, even demand for the foreign currency on the market decreases as importers opt to buy locally, paying in local currency. Export subsidies, however, promote export to foreign markets and at the same time induce a boost in the supply of foreign currency in the country. It is clear, therefore, that trade policies entail an inefficient equilibrium in the foreign exchange market as opposed to the natural equilibrium that would occur in the absence of tariffs and subsidies.

Let's think for instance about the effect of import taxes on the value of machinery the project will have to buy. The cost of the machinery at the port of entrance (c.i.f. price) is US$100, and the government levies a 20 per cent tax (T) on imports (M). Assuming an OER of 10 local currency units (LCU) = 1 US dollar, the total cost of the machinery for the importer, expressed in LCU, would be LCU 1,200 (tax included). Therefore, to pay in the foreign currency requested by the exporter, the importer buys foreign exchange from the State for LCU 1,000 (equal to US$100), and the State ultimately earns LCU 1,200, giving up "only" the 100 dollars requested. The spread created in this transaction is called the *import premium*.

Considering that for every unit of foreign exchange sold, the State gains (M+T)/M equivalent units of local currency evaluated at the OER, the import premium is thus equal to (T/M), corresponding to the average tariff on imports. Indeed, in our example the premium would be

200/1,000 = 0.2 (the 20 per cent tariff). In a perfect competitive market, where optimal allocation of resources is ensured, these markups do not exist, and the SER would always equal the OER.

By the same token and through the same logic, in the presence of export subsidies (S), the State buys foreign currency equal to X – the f.o.b. price of the exported good – paying to the exporters an amount (X+S).[21] Therefore, for every unit of foreign currency bought, the State pays (X+S)/X equivalent units of local currency evaluated at the OER. The *export premium* is that extra amount of local currency the State is willing to pay to acquire an additional unit of foreign currency. Therefore, this would be equal to S/X, which is equivalent to the average subsidy on exports.

The SER[22] is therefore equal to the wedge on foreign exchange multiplied by the OER, where the wedge is given by the sum of the import and export premiums: *SER = (1+premium) × OER*. As we saw in the previous paragraphs, the premium is ultimately a weighted average of the tariff and subsidy rates at play on the whole market. Thus, we can further elaborate the SER formula[23] as:

$$SER = \underbrace{\left\{\frac{[(M+T)+(X+S)]}{M+X}\right\}}_{(1+premium)} \times OER$$

Where:

- SER: Shadow exchange rate
- OER: Official exchange rate
- M: C.i.f. value of total imports (an average of five years is advisable)
- X: F.o.b. of total exports (an average of five years is advisable)
- T: Duties on imports
- S: Export subsidies (export taxes should be treated as negative subsidies).

BOX 2

C.i.f. and f.o.b. prices

Estimating the economic and financial prices relies on the use of c.i.f. (cost, insurance and freight) and f.o.b. (free-on-board) prices – the first values we need to consider when calculating the import and export parity prices of a project's items at the farmgate or project boundary.
In the table below, we present the main elements included in the c.i.f. and f.o.b. prices.

	C.i.f.	F.o.b.
Elements included	• F.o.b. cost at point of export; • Freight charges to the point of import; • Insurance charges; • Unloading from ship pier at port.	• All costs to get the good on board – but still in the harbour of exporting country; • Local marketing and transport costs; • Local port charges: taxes, storage, loading, fumigation, agents' fees, etc.; • Export taxes and subsidies; • Project boundary price; • Farmgate price.
Elements excluded	• Import duties and subsidies; • Port charges at port of entry for taxes, handling, storage, agents' fees.	

Source: William A. Ward, "Calculating import and export parity prices", quoted in Price Gittinger, *Economic Analysis of Agricultural Projects* (World Bank, John Hopkins University Press, 1982) p. 79.

21 In the case of an export tax, (S) would be negative and the equation would result in (X–S).

22 Rigorously, the shadow price of foreign exchange would be a weighted average of the different demand and supply prices of various imports and exports, where the weights depend on the relative elasticities of imports and exports demand and supply curves. See Belli, P. (ed.). 2001. Technical Appendix. Pages 232-238.

23 This is a simpler formula that includes the following assumptions: (a) uniform import duties and/or export taxes, and (b) equal import and export elasticities. A more complex definition requires estimating elasticities of demand and supply on the market, while also considering how duties and taxes vary according to the nature of the goods and services traded.

Implicitly, we can rewrite the formula above so as to derive a conversion factor for the foreign exchange that will be applied to financial prices to get rid of the taxation wedges on trade.

We will call this factor the *shadow exchange rate factor* (SERF), and it is given by:

$$SERF = \frac{SER}{OER} = (1 + premium)$$

Therefore, the premium represents the average shift of the OER rate from the SER and can be calculated as:

$$Premium = \frac{SER}{OER} - 1 \text{ or; } Premium = SER - 1$$

A numerical example will help clarify the procedure for estimating the SER, the premium and the SERF. Let's assume that our country presented the following statistical data about international trade.[24] The country shows a deficit in its trade balance, given that imports exceeded exports over the past years.[25] The government imposed an export subsidy[26] (5 per cent) and import taxes (14 per cent) on traded goods. As table 3 shows, the SER is greater than the OER, indicating a SERF equal to 13.06/12.39 = 1.06. The divergence of the OER from its real economic values (i.e., the premium) is equivalent to 6 per cent, indicating the presence – although limited – of trade restrictions in the country, an overvaluation of the OER[27] and a net premium on imports.

TABLE 3

Calculation of the SER

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Imports of goods and services (current US$ mil.)	2,183	2,180	2,442	2,180	2,259	2,225	2,818	2,674	2,394
Exports of goods and services (current US$ mil.)	1,805	1,838	2,119	1,744	1,775	2,063	2,205	2,168	2,093
Trade balance	-378	-342	-323	-436	-484	-162	-613	-507	-301

Average imports	2,373	a
Average exports	1,979	b
OER	12.39	c
Import duties	14%	d
Export tax	5%	e
SER	**13.06**	$\frac{[a+(a \times d)]+[b-(b \times e)]}{a+b} \times c$

24 Similar data are readily available on country statistical bureau websites or the websites of international organizations like the World Bank (http://wits.worldbank.org/default.aspx) or the International Trade Centre (http://www.intracen.org/itc/market-info-tools/trade-statistics/).

25 It is advisable to calculate the SER looking at the general trend of the trade balance for at least a five-year period, as a single-year estimate could be an unreliable measure of the general trend.

26 Remember, as a subsidy to exports, this would be deducted from the formula.

27 US$1.00 would buy 13.06 LCU when valued at SER and "only" 12.39 LCU when exchanged at the OER. Hence, the OER overvalues the domestic currency with respect to the dollar.

Usually, the SER is greater than the OER (i.e., SERF > 1 and premium > 0), especially in the context of a developing country that could simultaneously experience market distortions and a deficit in the balance of trade. The SER equals the market (or official) exchange rate only if all trade distortions, such as import duties and export taxes, are eliminated and if the market is able to guarantee the optimal allocation of resources.

It is important to remember that estimating the SER is required even when the OER is allowed to adjust freely and is set by the market, or even when there are no balance-of-payments deficits. Calculating the SER to approximate economic values is certainly the best approach when a country has relevant trade distortions.

c. The economic price of traded and tradable goods and services

Traded goods and services are either imported or exported by the country. Tradable goods and services include all those items the country could import (or export) under conditions of free trade, but does not because of excessive trade barriers such as very high import duties or other restrictions. Domestic market prices of tradable goods (inputs and outputs of the project) are usually distorted by market imperfections (monopoly, oligopolies, etc.) as well as by economic policies (trade barriers, subsidies schemes, policies on foreign currency, etc.).[28]

The economic price of traded or tradable goods and services is equal to the border price adjusted by the trade distortions in the country. To calculate such economic prices, we first determine the border prices of all traded and tradable goods and services, and then correct the border prices for trade distortions in the country.

Therefore, to proceed with the estimation of the project's economic prices, we need to calculate *import parity prices* (IPPs) and *export parity prices* (EPPs) for tradable inputs and outputs.

Parity prices are used in the financial analysis to understand whether tradable project commodities produced by the project would be competitive in the market. However, they are considered as a starting point in the calculation of shadow prices for the economic analysis because they provide a straightforward indication of the opportunity cost – or scarcity value – of such commodities at the international level. In other words, such prices provide a benchmark for the opportunity value of all the tradable resources used or produced in the project.

The IPP is the price that a purchaser would pay for imported goods; thus, it is equal to the c.i.f. import price plus tariff and transport cost to the purchaser's location. Therefore, the IPP is the cost of purchasing a good on the international market and transporting it to a particular location in the country. By conforming the IPP to the local price, we could determine whether importing a particular commodity is cheaper or more expensive than producing or procuring it locally.

Similarly, the EPP is the price that a producer would receive for its product if exported; hence, it is equal to the f.o.b. price minus the costs of getting the product from the farmgate to the border. A comparison between the EPP and the local sale price would help measure whether local exports are competitive internationally. Hence, the opportunity cost of a given traded or tradable good is based on its IPP or EPP, because these are the immediate opportunities forgone by the society for using such resources in the project instead of elsewhere.

28 Despite the general rule, in some cases tariff barriers are intended as corrections for price distortions in the world markets. Typical example: the international prices of dairy products, which are highly subsidized and exported by the European Union. Also, some internal prices might be the result of explicit national policies intended to encourage infant industries (for example, national production of fertilizers) with sound basis for developing future comparative advantages. In cases like these, it may be justified to adopt the internal prices instead of the border ones, at least for part of the projected period of analysis.

There are at least two ways to calculate border prices. The first way uses internal market prices. To do this, first we need to eliminate all transfer payments (VAT, subsidies, taxes and duties) from the market price. For an imported good, tariff rates (duties) should also be deducted to get a proxy of the c.i.f. price at the border. For an exported good, export taxes should be added to obtain a proxy of the f.o.b. price, and internal transport costs should be calculated to get the final border prices at a given location. The second way to calculate border prices uses international prices. International prices for most agricultural commodities and agricultural inputs can be found in FAOSTAT and in World Bank or other international agencies' data repositories. Statistical data provide c.i.f. and f.o.b. prices for different countries. If a given country is not included, c.i.f. prices can be obtained by adding to f.o.b. prices of origin the corresponding freight and insurance costs. When prices are not available through these sources, the analyst might calculate a proxy from national records by dividing the total value of the item's import (or export) price by the total quantity of its import (or export). Obviously, if we work the calculation starting from local market prices, then the border prices will be expressed in local currency. In the case of foreign prices, the border prices will be expressed in foreign exchange (generally in US dollars).

Table 4 shows how to calculate the financial IPP for a project input. The procedure would be different, depending on whether project items are inputs or outputs and are classified as importable or exportable. Detailed examples are provided in the annex.

Once calculated, financial parity prices should be corrected for trade distortions identified in the country. A first source of distortion is trade policies, and it is reflected in the difference between the OER and the SER (i.e., the premium on foreign exchange). Clearly, such a distortion would affect traded/tradable items

TABLE 4
Example of financial IPP for an importable project input

Detailed operations	Item: UREA	Financial value
data collected	a) C.i.f. price at port (US$/ton)	190
data collected	b) Official exchange rate	10
c = a×b	**c) C.i.f. price at port (LCU/ton)**	**1,900**
d = c×5%	d) Import duty (5% of c.i.f.)	95
e = (c+d)×10%	e) Value-added tax (10% of c.i.f. + duty)	199
f = (c+d)×12%	f) Special sales taxes (12% of c.i.f. + duty)	263
g = (c+d)×2%	g) Natural resources taxes (2% of c.i.f. + duty)	40
h = 1×1,000	h) Handling (1 LCU/kg)	1,000
i = (c+d)×1%	i) Storage fee (1% of c.i.f + duties)	20
j = (h+i)×50%	j) Port fee (50% of the storage fee and handling fee)	510
data collected	k) Transportation cost from port to farm (0.15 LCU/kg)	150
l = c+d+e+f+g+h+i+j+k	**l) Parity price at the farm gate (LCU per ton)**	**4,177**

only. A second source of bias is linked to domestic economy distortions, which affect both tradable and non-tradable project items. It is important to remember that in the economic analysis we need to bring to a same numeraire, and aggregate, all project items – both tradable and non-tradable. As the premium is paid exclusively on traded items, only traded items would be adjusted for trade distortions, while non-traded items would be valued at their local market prices or through their willingness-to-pay values.[29] To obtain the economic prices of traded and tradable goods and services, their border prices, still expressed in US dollars at the border, need to be converted into local currency by applying the SER[30] (see table 5). As was mentioned at the beginning of this section, all transfer payments (duties, taxes and subsidies) are excluded from the calculation.

The economic prices of traded and tradable goods and services, calculated through this procedure, should replace the corresponding financial prices before the analyst calculates the economic profitability indicators of the project. However, these calculations involve a great amount of data, and it might be difficult to obtain detailed information for each item. In many cases, the use of *conversion factors* (CFs) can simplify this procedure. These factors may be calculated for a group of items (e.g., fertilizers or machinery) and applied to each item in that category. The conversion factor of an item is the ratio between its economic price and its financial price:

$$CF = \left(\frac{Economic\ price}{Financial\ price}\right) = \left(\frac{Shadow\ price}{Market\ price}\right)$$

National planning agencies often calculate CFs for their main export and import goods. In these cases, the analyst only needs to apply such CFs to convert the financial market prices – used in the financial analysis – into economic prices. Otherwise, the analyst needs to undertake the detailed calculation of the pertinent economic price by (a) identifying the proper border price (f.o.b. for exportable and c.i.f. for

TABLE 5

Example of economic parity prices for an importable project input

Detailed operations	Item: UREA	Financial value
data collected	a) C.i.f. price at port (US$/ton)	190
data collected	b) Shadow exchange rate[a]	11
c = a×b	**c) C.i.f. price at port (LCU/ton)**	**2,090**
d = c×5%	d) Import duty (5% of c.i.f.)	0
e = (c+d)×10%	e) Value-added tax (10% of c.i.f. + duty)	0
f = (c+d)×12%	f) Special sales taxes (12% of c.i.f. + duty)	0
g = (c+d)×2%	g) Natural resources taxes (2% of c.i.f. + duty)	0
h = 1×1,000	h) Handling (1 LCU/kg)	1,000
i = (c+d)×1%	i) Storage fee (1% of CIF + duties)	20
j = (h+i)×50%	j) Port fee (50% of the storage fee and handling fee)	510
data collected	k) Transportation cost from port to farm (0.15 LCU/kg)	150
l = c+d+e+f+g+h+i+j+k	**l) Parity price at the farm gate (LCU per ton)**	**3,770**

[a] The premium on the exchange rate is assumed to be equal to 10%.

29 This is the main step differentiating the use of a domestic price numeraire (and the SER), where only distortions on traded/tradable items are corrected, from the use of international price numeraire (and the SCF), where only distortions on non-tradable items are corrected. More details are provided in the following sections.

30 Remember, the numeraire used here is the domestic price level expressed in local currency.

importable); (b) applying the SER to the border price to calculate the corresponding domestic economic price in local currency; and (c) eliminating all duties, taxes and subsidies.

Table 6 compares the procedure for computing the conversion factor of urea, and all calculation steps and differences between the financial and the economic procedure are visible. Assuming all fertilizers in the country are equally taxed, the same conversion factor of 0.9 could be applied to convert the financial price of all project fertilizers, without the need to estimate other ad-hoc measures.

d. The economic price of non-tradable goods and services

Non-tradable goods are those that by their nature either cannot be traded or are uneconomical to trade internationally. Labour, land, real estate, hotel accommodations, electricity (in some cases), health services, haircuts and other services are typically non-tradable. Non-tradable goods and services also include items whose costs of production and transportation are so high as to preclude trade, even under conditions of free trade. In principle, goods and services fall into this category if their c.i.f. cost (landed price) is greater than their local cost – preventing importation – and at the same time their local cost is greater than the f.o.b. price, impeding exportation.

The calculation of shadow prices for non-tradable goods can be extremely time-consuming, and the project analyst must decide whether the refinement is worth the additional effort. Alternatively, the analyst might choose to calculate sector-wide CFs and apply them to the different non-traded goods categories. This would require breaking down non-tradable items into their traded (e.g., machinery parts) and non-traded (e.g., local labour) components, converting the former with economic parity prices and the latter with domestic values. In exceptional cases, shadow prices should be estimated on the basis of long-run marginal cost or willingness-to-pay methods.[31]

TABLE 6

Conversion factor of urea as an importable input

Item: UREA	Financial value	Economic value
a) C.i.f. price at port (US$ per ton)	190	190
b) Exchange rate	10	11
c) C.i.f. price at port (LCU per ton)	**1,900**	**2,090**
d) Import duty (5% of c.i.f.)	95	0
e) Value-added tax (10% of c.i.f.)	199	0
f) Special sales taxes (12% of c.i.f.)	263	0
g) Natural resources taxes – 2% of c.i.f.	40	0
h) Handling (10 LCU per kg)	1,000	1,000
i) Storage fee (1% of c.i.f. and duties)	20	20
j) Port fee (50% of the storage fee and handling fee)	510	510
k) Transportation cost from port to farm (0.15 LCU per kg)	150	150
l) Parity price at the farmgate (LCU per ton)	**4,177**	**3,770**
	Conversion factor (EP/FP)	**0.9**

31 See *Guide to cost-benefit analysis of investment projects*, European Union. The willingness-to-pay (WTP) approach allows the estimation of a money value through users' revealed preferences or stated preferences. Users' preferences can be observed either indirectly, by observing consumers' behaviour in a similar market, or directly, by administering ad hoc questionnaires (but this is often less reliable). For the evaluation of some outputs, when the WTP approach is not possible or relevant, long-run marginal cost (LRMC) should be used. Usually WTP is higher than LRMC in empirical estimates, and sometimes an average of the two is appropriate.

If there are no major indications that a significant market distortion (monopoly, rationing policies, etc.) is affecting one or more project non-tradable items, then the recommendation is to use market prices, net of internal transfers (VAT, subsidies, etc.), as shadow prices for these goods and services (CF = 1). This is the rule for a numeraire in local currency at the domestic price level.

However, if the numeraire is the international price level, prices of non-traded goods and services should be converted using the inverse of the SERF – the standard conversion factor SCF – while traded/tradable items should be valued at their international prices and converted to local currency using the OER.

e. The shadow price for labour

A crucial input in rural investment projects is labour. In principle, wages should reflect the social value of working time and effort (i.e., the marginal value to society of the product of a unit of labour). In a perfectly competitive economy with no taxation on labour, no distortions affecting the labour market and no unemployment, market wages would be a reliable measure of the opportunity cost of labour in the country. In the real world, however, wage distortions are very frequent. Current wages may be a distorted social indicator of the scarcity value of labour in imperfect labour markets, particularly where there are macroeconomic imbalances, as revealed by high and persistent unemployment or by dualism and segmentation of labour conditions (e.g., when there is an extensive informal or illegal economy).

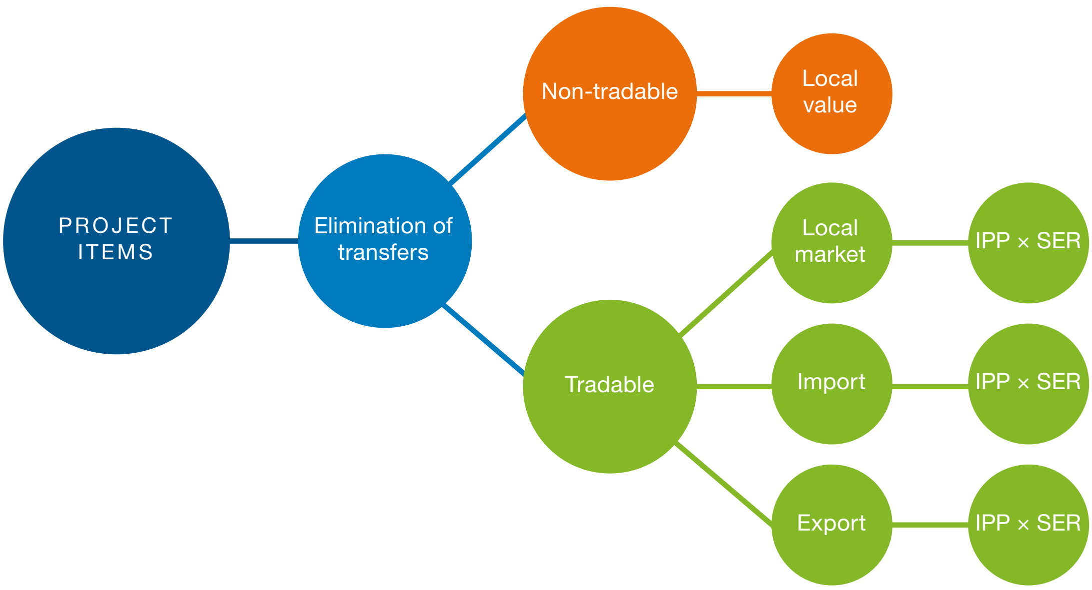
Typically, IFAD projects are undertaken in areas[32] characterized by high unemployment or underemployment. Given the surplus of labour, people in the area would in theory be willing to work for a lower wage than the market one. The economic price of labour (wage) should be lower to re-establish the equilibrium. However, wages are very rigid, and labour markets may be distorted with measures such as minimum wages, work union pressures and collective agreement.

The *shadow wage rate* (SWR) reflects – better than the market wage – the opportunity value of labour in the economy. To be included in the economic analysis of the project, the SWR is determined as follows.

- The SWR for skilled labour (a low share of the work supply in developing countries) should be considered equal to the prevailing market wage after taxes. In case of full employment, however, the forgone opportunity wage – that is, the wage given up to participate in the project – should be

FIGURE 3

Economic pricing in the case of domestic price level numeraire



32 The economic wage is area-/region-specific because labour is less mobile than capital.

considered. Most times, as the supply of qualified labour is very scarce, the economic wage would be higher than the market one. Also, when there is strong emigration, fewer people are available at the local place and economic wages should be higher than actual market ones.

- The SWR for semiskilled labour should be a weighted average between the wage rate in the informal sector and the wage rate in the formal sector. The weights in the calculation of the SWR are given by the share of each work category sourced by the project. If, for example, the project will employ 80 per cent of people who could find an occupation at an after-tax formal salary of 10 LCU/day and 20 per cent of people who are normally employed at an informal wage rate[33] of 6 LCU/day, the daily SWR would be equal to:

$$SWR = 10 \times 0.8 + 6 \times 0.2 = 9.2\, LCU/day$$

- The casual wage in rural areas can be taken as an indication to determine the SWR. The SWR for unskilled labour should be based on the forgone opportunity casual wage dismissed – or on the opportunity output value of informal activities forgone[34] – while participating in the project. Normally, the SWR for unskilled workers employed in informal activities should be equal to, or not higher than, the value of the output forgone in these activities.
- Under conditions of severe unemployment and lack of unemployment benefits (conditions not so rare in rural areas), the shadow wage may be inversely correlated to the level of unemployment. For example, if unemployment in the region is estimated at 30 per cent, then the daily shadow wage would be equivalent to 70 per cent (LCU 7) of the market wage (LCU 10).

As an example, let's assume the project is introducing maize farming as a new activity to replace paddy cultivation. In the WOP scenario, a farmer would allocate 60 per cent of her maximum working time (assumed to be 200 days) to paddy cultivation (120 days) and the remaining 40 per cent (80 days) to other productive activities. For paddy and other activities, she would receive an untaxed daily wage of LCU 10 and LCU 8, respectively (table 7). Thanks to the project, the same worker would be employed only in maize cultivation for 130 days, at a daily wage of LCU 17, on which she pays a 10 per cent tax; thus, the net daily wage would be equal to LCU 15.3 (table 8). The remaining 70 days would be allocated to leisure, as she has a higher income than before, while working less. In the financial analysis, these are exactly the prices and quantities we would consider in drafting our farm budgets.

TABLE 7
Labour allocation in the WOP scenario

	Net daily wage (LCU/ day)	Number of days worked	Net annual salary
Paddy (WOP)	10	120	1,200
Other (WOP)	8	80	640
Total		**200**	**1,840**

TABLE 8
Labour allocation in the WP scenario

	Net daily wage (LCU/ day)	Number of days worked	Net annual salary
Maize (WP)	15.3	130	1,989
Total		**130**	**1,989**

In economic analysis, to estimate the opportunity cost of labour, we would consider a weighted average of the forgone earnings for those unallocated days jointly with the earnings for her work. Our farmer, in addition to cultivating maize, may have worked an additional 42 days (60 per cent of the remaining 70 days) in paddy and an additional 28 days (40 per cent of the unallocated 70 days) in other activities, at the corresponding salaries. In this case, the evaluation of the SWR would be as follows:

$$SWR = \frac{15.3 \times 130 + 10 \times 42 + 8 \times 28}{200}$$

$$= \frac{2{,}633}{200} = 13.16\, LUC/day$$

33 The informal salary is seldom taxed.

34 Information on this aspect should be consistent with the WOP scenarios considered in the analysis.

Therefore, in the economic analysis carried out with the domestic price level numeraire, the labour should be valued at a daily wage equal to the SWR of 13.16 LCU/day instead of its market wage of LCU 18 (gross daily wage) or LCU 15.3 (net daily wage). Alternatively, we can calculate the related CF for labour and apply it to each wage used in the financial analysis, resulting in:

$$CF = \left(\frac{Economic\ price}{Financial\ price}\right) = \frac{13.16}{17} = 0.77$$

It is important to remember that, if the international price level numeraire were used, the SWR should be multiplied by the SCF to obtain the opportunity cost of labour in international price equivalent values. Therefore, taking our previous estimate of the SWR and assuming a SER of 1.2 – hence, a SCF of 0.83 – the SWR and the related CF for the economic analysis under the international numeraire would be equal to:

$$SWR = 13.16 \times 0.83 = 10.9\, LCU/day$$

$$CF = \frac{10.9}{17} = 0.64$$

f. The social discount rate (SDR)

Costs and benefits occurring at different times need to be discounted to be comparable. The main rationale for social CBA is the existence of market failure. Because of distortions and ill-defined property rights, the actions of private agents operating through the market do not necessarily result in an efficient allocation of resources; therefore, there is a possible role for government in scrutinizing and regulating proposed private projects and undertaking public projects. A conspicuous, but unavoidable, market failure is the absence of future generations in today's capital market, where the quantity of resources to be invested now to provide for future consumption goods is determined. If the needs of future generations are not adequately taken into account in the operation of private capital markets, the private sector will undertake too few investment projects. In other words, the private market interest rate will be too high a hurdle for judging the appropriate rate of return on long-lived private and public projects.[35]

The discount rate in the economic analysis of investment projects – *the social discount rate* (SDR) – reflects the social perspective on how future benefits and costs should be valued against present ones. The essential economic role of the SDR is to guide the allocation of public resources into the most desirable social investments. If the SDR is set too low, demand for public investment resources will exceed supply, since too many projects will have a positive present value. If it is set too high, too few projects will pass the absolute efficiency test of a positive present value.

The interest rate at which a country can actually borrow capital from a relevant international capital market should be taken as a reference point for the estimation of the SDR to be used in the evaluation of investment projects (SDR = r). Among the existing interest rates on the relevant world capital market, the interest rate on long-term loans would be the appropriate basis for estimating the SDR.

The SDR differs from the financial discount rate when capital markets are inefficient (for example, when there is credit rationing, asymmetric information and myopia of savers and investors). Actually, in theoretical terms, the SDR is the equilibrium rate that comes from the intersection of the alternative capital returns supply curve (i.e., marginal investment returns curve) and the consumers' intertemporal demand curve (savings curve). It can be viewed either as the "scarcity price" of capital resources or as the "price of future generations' consumption". As a general rule, when a country is a capital borrower, the SDR should be no less than the actual interest rate on the capital market from which the capital is borrowed.

There are special cases in which different discount rates are suggested – for example, when governments are giving priority to encouraging the rapid growth of some less-developed regions. Speeding up their development may be justified on social, economic and political grounds (e.g., better income distribution, employment, politically sensitive areas), but the strict application of a uniform discount rate may prevent the projects from passing the absolute efficiency test

35 Benefit-Cost Analysis: Financial and Economic Appraisal using Spreadsheets: Campbell & Brown, Cambridge University Press (2003).

BOX 3

SDR according to different sources

- The World Bank normally applies an SDR of 10%, reflecting its experiences in the last decades.
- The European Union normally applies an SDR of 5%.
- An SDR of 6.5% that was used in the EFA of the Territory Rural Development in the Mixteca Region (Mexico) was based on the analysis of the following rates:
  - Wall Street Journal Prime Rate: 3.25% (August 2011);
  - Mexican Treasury Bonds term 10 years, in $MXN: 6.25%;
  - Discount rates on mortgage loans (USA) term 30 years: 4.19% (August 2011).

and therefore from promoting the development of these regions.

The rationale behind this approach is that it is more convenient to lower the discount rate than to try to estimate the project's impact on distributional policy objectives and additional expected future benefits. This means that a differentiation in the SDR for less-developed regions may be desirable. The decision on setting up regional SDRs should be taken by a national policymaking institution in accordance with the government's regional development policy. The special (lower) SDR for a given industry/region could be estimated as follows:

$$ri = SDR - i$$

Where:

ri: a special promotional SDR for a given industry/region

SDR: uniform social discount rate

i: premium for an industry or a region leading to the lowering of SDR

In practical terms, this means that the SDR should be equivalent to the interest rate that corresponds to IFAD's ordinary lending terms.[36] Still, whenever financial market conditions result in a very low interest rate (as has been the case since 2007 because of the financial global crisis), these IGs suggest using a rate of 5 per cent as a minimum threshold, as is common practice in other IFIs (e.g., EU, see box 3).

g. Alternative numeraires and the calculation of economic prices

In previous sections, the chosen numeraire for the economic analysis was the domestic price level expressed in local currency. This is the numeraire recommended by these guidelines. While the selection of the numeraire does not affect final results of the analysis,[37] it does determine the procedure to be followed for calculating the shadow or economic prices.

When the adopted numeraire is the domestic price level, we saw how using the SER on traded items helps reduce distortions on market prices – and the OER – caused by trade barriers. However, if the analyst chooses to use the international price numeraire, the conversion of project inputs and outputs should be made by means of the SCF. The SCF is strictly related to the premium calculated in the SER formula above, as it is equal to:

$$SCF = \frac{1}{Premium}$$

Or alternatively:

$$SCF = \frac{OER}{SER}$$

Consequently, in the example provided in table 3, our SCF would equal the inverse of the premium. Unlike the premium, the SCF is applied to non-traded items, while traded items are estimated at their international economic price. In other words, when choosing the international price level numeraire, only 95 per cent of the domestic resources values

36 IFAD ordinary terms loans apply an "average rate" based on world market rates. In early 2019, the average rate is equivalent to 3.86 per cent for loans denominated in US dollars, reflecting the current situation in financial markets.

37 If profitability indicators are positive under one numeraire, they will remain positive under the other. Differences in the NPVs of the project would be proportionate to the SCF (or the SERF, depending on the numeraire used). The ERRs would remain unchanged, irrespective of the numeraire selected.

BOX 4

When to use the SER or SCF: a quick summary

As we have seen, the OER is often a biased estimator of the relative value of domestic currency to a foreign currency; therefore, to ensure a balanced comparison between international and domestic prices, a correction factor of the two currencies is needed. The SER and the SCF respond to this need, and the decision on using one or the other depends purely on the numeraire used. Obviously, the selection of one numeraire (and parameter) immediately excludes the selection of the other, and in no instances can the SER and the SCF be used simultaneously in the economic evaluation of a project.

When the numeraire is the domestic price level, the analyst calculates the SER and applies it in converting the border prices of tradable goods. The non-tradable goods maintain their domestic face value, and only the tradable goods are adjusted.

When the numeraire is the international pricing system, the international price of traded/tradable goods is simply converted into local currency at the OER, while the value of non-tradable goods and services (already valued at the OER) is adjusted for the SCF coefficient.

	Domestic numeraire	World numeraire
Traded goods	Border prices × SER	Border prices
Non-traded goods	Domestic market price	Domestic market prices × SCF
Taxes	Excluded	Excluded
Labour	SWR[a]	SWR × SCF

[a] SWR is the shadow wage rate.

These IGs recommend using the domestic numeraire and the SER; and whenever possible, the analyst should use the SER estimation provided by the national planning authorities.

should be included in the economic evaluation of our project.

The SCF is usually lower than 1, indicating – as in the case of SER > OER – that the domestic currency is overvalued and domestic resources are overrated. As has been discussed, this in turn could be related to the exchange regime or to other market forces and domestic inefficiencies.

Other economic benefits

Other economic benefits are those than can be quantified relatively easily, but not as easily as agricultural production or improved access to markets. Among these benefits are projects' investments in infrastructure outside the farms/households, to guarantee the success of the technical proposals for the farms/households. These investments are diverse – rural roads, drinking water systems, rural electrification and so on – and they generate benefits not only for direct beneficiaries, but also for other farms/households that are in the project area.

Evaluating these benefits requires (a) establishing the economic value of the benefit by farm/household, and (b) establishing how many farms/households will receive the benefit in each implementation year of the project.

The economic value of the benefit is usually set in an indirect way – for example, the annual savings for each family in medicines and visits to the hospital as a result of a drinking water system, or the savings in freight rates and reduction of agricultural product losses as a result of a rural road. For an objective and correct assessment of these benefits, research on the ground is required.

As an overview of possible examples, table 9 summarizes quantifiable benefits for different investments. In addition, detailed case studies are provided in volume 3 of IFAD's internal guidelines on EFA.

TABLE 9

List of quantifiable benefits by category of investment

Investment	Quantifiable benefits
Rural infrastructure (storage and processing facilities, Irrigation systems)	▶ Reduction in post-harvest losses ▶ Increased value of the final product due to investments in storage and cooling facilities, or small-scale processing (like drying or storing) ▶ Increases in production and productivity thanks to increased availability of water
Value chain (collective marketing; warehouse receipt systems; increased market information)	▶ Increased value of the final product thanks to increased access to markets ▶ Creation of internal and external markets that did not exist before investments ▶ Distribution of value-added among the main actors of the value chain
Rural roads	▶ Reduction in transportation and vehicle maintenance costs ▶ Increased volume of agricultural products transported for sale ▶ Reduction in post-harvest losses because of better access to sale points
Domestic water supply	▶ Time saved from not having to carry water from the original source ▶ Reduction in sickness through consumption of safer water ▶ Reduced loss of water through leakage ▶ Increased productivity through the irrigation of small plots and the provision of water for livestock ▶ Backyard gardening
Soil conservation practices (changes in tillage practices, crop rotations, land/soil conversion, afforestation, flood prevention)	▶ Reduced land erosion: an estimate of the saved nutrient content can be valued at the price of fertilizer needed to replace that nutrient content ▶ Increasing crop, timber and livestock yields through soil preservation, conservation tillage and agriculture ▶ Increased final product value thanks to labelling as organic agricultural practices ▶ Avoided costs of rehabilitating public infrastructure destroyed by natural disasters ▶ Energy saving thanks to replacement of old practices by eco-friendly technologies (eco-stoves, solar panels, etc.).
Land registration	Land tenure security may translate into increased land value explained by: ▶ Long-term investments for land fertility ▶ Improved access to credit as land can be used as a collateral guarantee for credit ▶ Greater dynamism of land markets ▶ Environmental benefits as a result of improved or maintained forest

Quantifying externalities

A project may use resources without paying for them (i.e., natural resources) or may generate resources to other economic agents that do not pay for them (i.e., improvements in the quality of honey due to the introduction of new pastures). These external effects, not considered as the main objective of the project, are called *externalities*. Classic examples of externalities related to agricultural production are, for instance, increased pollination thanks to beekeeping (positive externalities), or lack of water for downstream populations if irrigated agriculture in upstream territories is intensified (negative externality).

In IFAD, very few projects have identified or quantified positive or negative externalities. The most likely reason is that project analysts do not take into consideration the importance of these impacts (particularly on the environment). However, these effects are real costs and benefits for the economy as a whole caused by the project, and they should be included in the economic analysis as project costs or as project benefits.

Many externalities associated with agricultural productive projects can be measured without major difficulties. For example, positive or negative externalities related to carbon sequestration are made easily available, thanks to ad hoc software (e.g., the FAO Ex-ACT tool[38]). The value of livestock losses due to a new disease or the value of incremental honey production are also externalities (negative and positive) that can be easily measured. In these cases, positive externalities should be clearly identified and added to the flow of project benefits, and negative externalities should be added to the flow of project costs.

However, valuing externalities (particularly environmental impacts) can sometimes be difficult, even though they may be easily identified. A project may, for example, generate ecological damage whose effects, combined with other factors, will take place in the long run and are difficult to quantify and value today.[39] Such impacts should at least be identified in physical terms for a qualitative appraisal to provide decision-makers with more elements for an informed decision, by weighing up the quantifiable aspects, summarized in the economic rate of return, against the less quantifiable ones.

Aggregating the economic results

Aggregating the whole-project effects requires describing who (how many people) will engage in each activity/model, and when, throughout the project implementation period. This information must be presented in an *incorporation matrix*, developed through a collective consultation with all mission members.

The procedure to calculate the net incremental economic benefits for the whole project involves the following steps:

- Aggregating the cash flow of net incremental economic benefits of all farms and enterprise models involved (i.e., the project direct beneficiaries).
- Aggregating the cash flows of other economic benefits (for example, economic benefits associated with the construction of rural roads, with water supply facilities, etc.).[40]
- Aggregating economic benefits or costs of positive and negative externalities.

These aggregated economic benefits needs now to be compared to the economic cost of the project, as the comparison of these economic flows, discounted with an appropriate discount rate, provides the economic profitability indicators of the project.

Transforming financial project costs into economic project costs

Total project costs are calculated in financial prices (i.e., market prices). Usually, some specific software (e.g., COSTAB) is used to facilitate calculations and different presentations of project costs (e.g., arranged by components, by expenditure categories, or by financiers). To obtain project economic costs for undertaking the project economic analysis, the following steps are recommended:

(a) Deduct price contingencies from total project costs.

(b) Avoid including costs already taken into account when formulating farm and activity models and budgets. Usually, these costs are included in project components such as grants, credit, financial services and so on. This task is not simple if these investments are not properly identified in COSTAB; therefore, it is important to include them in an expenditure category that is dedicated exclusively to these investments.

(c) Recalculate the flow of project costs for the remaining project components – e.g., peasants' organization, extension services, rural infrastructure, management and administration, monitoring and evaluation.

(d) Convert this flow of project costs, expressed in financial prices, into project economic costs.

To convert the project financial prices into economic prices, the best option is to use conversion factors (CFs) for the different goods and services included in the project costs. The calculation of the CF for the different items of costs should be undertaken rigorously: that is, imported goods and services should be valued at their economic prices,

38 For detailed examples of how to integrate externalities and the use of tools such as Ex-Act into EFAs, please refer to IFAD's EFA Internal Guidelines, Volume 3, Case studies, pages 17-33.

39 See section VI for more information.

40 The Guideland project does not include this type of benefit.

non-tradable goods and services should be valued at their market prices (net of indirect taxes), and so on.

When the calculation of project costs is performed with COSTAB, it is relatively easy to obtain the economic costs because the software includes a feature to do so.[41] COSTAB requires the introduction of SER and SCF or, alternatively, the introduction of CF, parity prices, and import taxes or duties for project items. When the estimate of the project economic cost is made without using COSTAB, the economic prices must be calculated manually.

Calculating economic profitability indicators

There are three main indicators of economic profitability: (a) economic net present value (ENPV), (b) economic internal rate of return (EIRR), and (c) benefit-cost ratio (BCR).[42]

- The ENPV is the difference between the present value of benefits (inflows), minus the present value of the costs (outflows) of an investment project, discounted using the SDR. When the ENPV is positive (> 0), the investment project is considered profitable. The ENPV is also used to prioritize investment projects. When project options are comparable and mutually exclusive, the decision rule is to approve the project that provides the greatest ENPV. The calculation is performed by obtaining the annual net benefits (annual benefit minus annual cost) for the period of the project evaluation. Long ago, the calculation was cumbersome and complex, but financial calculators and software such as Excel have facilitated this task.
- The EIRR is closely related to the ENPV. It is defined as the value of the discount rate that would make the ENPV equal to zero, for a given investment project. As usual, when the EIRR > SDR, then the project can be considered economically viable.
- The BCR is the ratio between the net present value of benefits (inflows) and the net present value of costs (outflows) of an investment project, discounted by the SDR. An investment project is considered profitable if the BCR is greater than 1.

All these indicators help address the question of whether the country *should* invest in the project. However, before we can calculate these indicators, there are two key parameters that need to be defined: the *period of discount* and the *discount rate*.

The choice of the discounting period (or time horizon of the analysis) is based on the following considerations: (a) the lifetime of the investment, that is, the time it takes to achieve full development; (b) when the productive cycle is short, then the lifespan of the main investments (e.g., machinery, storage facility, irrigation systems). These criteria are valid for all types of farm models that include on-farm investments with long lifespans and/or long investment periods (e.g., permanent plantations, irrigation and drainage facilities, livestock development, other infrastructure). For such projects the discount period is usually 20 years. In other cases, as in projects fostering crop enhancement by use of better inputs, the period of discount can be shorter, but a minimal discount period of ten years is advised.

As described in previous sections, the selection of the SDR is necessary for the calculation of ENPV and it is the reference value used to draw a comparison with the EIRR. As the SDR aims to analyse the benefit to society as a whole, it has to be equivalent to the cost of money for the country in the capital market, either with external financing or in the internal market, for example, through Treasury Bonds. These IGs recommend a value for the SDR of 5 per cent, in line with the OECD, EU and IMF approaches.[43]

Sensitivity analysis and project risk

The economic analysis of projects is by definition built on uncertain future events. Estimating the basic cost and benefit elements of the project, such as input and output prices and quantities, inevitably involves explicit or implicit probability judgments. To

41 Options: Produce economic values.

42 More information on how to calculate these indicators is provided in the IFAD EFA Internal Guideline Volume 1.

43 IMF Unification of discount rates paper (2013).

contain these uncertainties and measure their impact on project results, there are some techniques that would help detect critical variables or sources of major risks for the project and, in turn, set the basis for introducing effective mitigating measures.[44]

One of the most common tools used in CBA is the sensitivity analysis (SA). SA identifies how a change in key parameters and quantities would affect the profitability indicators. Variations, positive or negative, are likely to occur during project implementation (e.g., reduction of benefits, increase in costs, delays in implementation) and affect the project's financial and/or economic performance. The most relevant questions to be answered with this tool are, How will fluctuations in quantities and prices affect project performance, and which of the identified variables should be most closely monitored?

The analysis is carried out by testing the variation of one element at a time by determining the effect of that change on project performance. In practical terms, standard percentage variations of 10-50 per cent on benefits and costs, as well as one to three years' delay in project implementation (which affects the temporary distribution of costs and benefits), are tested to assess their impact on project economic performance indicators (ENPV and EIRR).

By linking the SA to identified project risks, the analysis provides grounded information for the development of efficient mitigation measures as well as the assessment of the risk severity. This can be done by assigning to each risk category a proxy variable to be tested in the sensitivity analysis (> costs; < benefits). For example, if local implementation capacities are low, the SA can test how a delay in implementation of one or more years (a realistic consequence of this risk) will affect project outcomes. Likewise, if there is a high probability of the introduction of import taxes, this can be tested by increasing input costs. By observing to what extent these events will change the profitability indicators, the project designer can easily identify the "critical risks" and better allocate resources for their mitigation.

IFAD has adopted the risk integrated framework (RIF) listing nine risk categories. The SA can provide useful information on the impact or "severity" of some of these categories that can easily be identified thanks to the traffic light signalling code. Generally, the risk categories to consider are the following:

(a) **Institutional risks:** institutional weaknesses can cause implementation delays, leading to significant lags in the generation of project benefits. A mitigation measure could be to provide technical support/assistance during project implementation, and to assume a slow build-up in benefits.
(b) **Market risks:** a market glut (oversupply) in the regional market can cause lower market prices, leading to a significant decrease in benefits; a mitigation measure could be a more diversified production pattern and provision of information on alternative markets.
(c) **Policy risks:** tariffs or duties imposed on the project's inputs can increase project costs substantially. A mitigation measure could be the negotiation of tariffs or duty exemptions.

Switching value (SV) indicators also help detect the most critical project variables. More precisely, the SV indicator provides the percentage change in costs or benefits that would bring the ENPV of the project to zero, or more generally, would cause the outcome of the project to fall below the minimum level of acceptability. SVs may be used for setting thresholds for the maximum percentage increase in costs or reduction in benefits. Using this indicator, the project team might establish some "trigger value" that will activate specific mitigation measures. For example, if the internal price of a specific input rises by 30 per cent, activities should shift to an alternative crop.

The formula for the SV of benefits is:

$$SV_B = \frac{PV_C - PV_B}{PV_B}$$

Where:
PV_C = Present value of costs
PV_B = Present value of benefits

44 One of the most useful techniques for dealing with uncertainty is the randomized probabilistic risk analysis carried out with the Monte Carlo simulation. Detailed case studies on the use of this technique are shown in IFAD's EFA Internal Guideline Volume 3, pages 124-134.

Similarly, the formula for the SV of costs is:

$$SV_C = \frac{PV_B - PV_C}{PV_C}$$

Table 10 provides an example of how to use the SA and link it to the risk integrated framework.

TABLE 10

Sensitivity analysis combined with risk

Sensitivity analysis

	Δ%	IRR	NPV (US$)	Link with risk analysis
Base scenario		**30%**	**46.47**	
Project benefits	-10%	20%	16.32	Combination of risks affecting output prices, productivity and adoption rates
	-20%	16%	5.46	
Project costs	10%	20%	17.75	Increase of energy prices
	20%	17%	10.24	
1 year lag in benefits		19%	12.63	Risks affecting adoption rates and low implementation capacity
2 years lag in benefits		14%	1.37	
Output prices	-10%	19%	12.97	Low management and negotiation capacity of women's groups
	20%	14%	0.68	
Input prices	10%	22%	21.51	Market price fluctuation
	20%	20%	17.75	
Adoption rates	-10%	19%	11.95	Extension service outreach is limited, low uptake of good practices
	-20%	16%	2.05	
Adoption rates	-10%	16%	3.76	

Integrated risk framework

Risk categories	Risk probability	Risk impact (severity)
1. Political and governance	HIGH	LOW Drop from 30 to 20%
2. Macroeconomic	MEDIUM	
3. Sector strategies and policies	LOW	MEDIUM Drop from 30 to 17%
4. Technical design of project or program	MEDIUM	MEDIUM/ HIGH Drop from 30 to 14%
5. Institutional capacity for implementation and sustainability	HIGH	HIGH Drop from 30 to 14%
6. Financial	MEDIUM	
7. Procurement	MEDIUM	
8. Stakeholders	LOW	MEDIUM Drop from 30 to 16%
9. Environment and social	LOW	

Results from the above tables reveal that:

- Political and governance risks can affect the implementation arrangements of a project and delay start-up. Tests in SA as one or two years lag in benefits reveal a high sensitivity to this risk (drop to 19 and 14 per cent from base scenario 30 per cent) and an important item to flag for project managers.
- Macroeconomic aspects can translate into high market price fluctuation, which according to the SA will not cause a severe impact on project outcomes.
- Sector policies can affect taxes and subsidies and therefore have an impact on overall project COST as tested in the SA (+10 and 20 per cent).
- Technical aspects of the project are tested by looking at drops in adoption rates and/ or productivity, translated in decreases in benefit (-10 or -20 per cent); in adoption rates or increasing in costs (+10 and 20 per cent), the result of these tests show that the impact on overall project profitability can be severe (19 and 16 per cent IRR from a base scenario of 30 per cent).

SECTION IV

The Guideland project example

Financial analysis

The "Guideland" hypothetical example is provided as a practical illustration of the application of IFAD's guiding principles on EFA. When properly elaborated, this analysis offers all the necessary data regarding inputs and outputs, their financial prices and how they are distributed over time. All costs and revenues should be valued at constant market prices in domestic currency, to ensure that project outcomes are not affected by inflation.[45]

Brief description of the project example

The proposed project[46] is located in a hilly area in the country of Guideland. The agro-ecological conditions are tropical and humid.

The national currency of Guideland is the $. The rural income poverty line in the region is estimated at $2,430 per rural household of four people. Both men and women work on the farm – the men 300 days/year, the women 150 days/year as they are also in charge of the children and household chores. The local rural wage is estimated at $2.0/day.

Typical crops in the area are cassava, maize, banana and coffee. There are approximately 2,000 poor smallholdings (average area of 8.0 ha) in the project area. Most small farmers cultivate only three crops in their holdings: maize and cassava, mainly for self-consumption (food crops), and banana to be sold (cash crop), covering in total up to 2.5 ha.

Agronomists consider that adopting improved technologies would increase farmers' production and productivity of existing crops, and that the introduction of a permanent cash crop, such as coffee, in the vacant hills, would substantially increase farmers' mid- and long-term incomes. Therefore, the preliminary project components are (a) extension services, and (b) a project management unit.

The incremental on-farm investments are supposed to be financed with "family savings". Total project costs, under this alternative, are estimated at $6.3 million, which would include the costs of extension services and the project management unit.

The country has little (negligible) inflation. The passive interest rate[47] is 7 per cent. There are restrictions on foreign trade (import duties of 25 per cent and export taxes of 15 per cent). In rural areas there is an unemployment rate of 30 per cent. Indirect taxes (VAT) apply to all goods and services (10 per cent). The official rate of exchange is US$1 = $1.15.

After a careful and detailed field visit, which should include interviews with potential beneficiaries and local technical staff, as well as a review of the available statistical information, it is time to formulate the crop and farm models.

Crop models

The technical parameters necessary to develop these models are generally provided by the government's extension agencies or by the mission agronomist, as well as through field visits to observe current practices and assess the productive constraints farmers face.

It is during the elaboration of crop models that the current production techniques are analysed and compared with at least one alternative, using such criteria as (a) higher NPV or IRR; (b) market projections; (c) reduced technical and production risks; (d) amount of family labour, in days per year; or (e) remuneration of family labour, in $ per day

45 Constant and real prices are often mistaken for each other. Constant prices, by definition, do not change over time, while real prices are deflated by inflation and change over time because of the change in the relative price system. Constant prices are used to be able to attribute project outcomes to changes in produce volumes and quality, independent of changes in the relative price system.

46 This project is an adaptation of one of the FARMOD examples developed by Gordon Temple et al.

47 The interest paid to saving accounts in local banks.

worked. The experts should compare alternatives and decide on one option to use as the WP situation for the project. This process is in theory an iterative process of trial and error that also considers aspects of sustainability, as will be seen in the next sections.

As has been mentioned, when developing the without-project (WOP) scenario, it is very important to avoid confusing "present situation" and "WOP situation". The WOP situation is a forecast of the present situation into the future and may be characterized by an improvement or a deterioration of actual present conditions (e.g., yields declining over time).

The WP situation will describe required inputs and outputs to be generated by the new agricultural practices, first in physical and then in financial terms, following the same type of analytical tools as for the WOP situation. The clear presentation of this information is basic to understanding the "expected benefits" to be generated by the project.

To represent the productive condition in Guideland, four crop models – for maize, cassava, banana and coffee – each of 1 ha, were developed and illustrated in tables describing their physical and financial parameters (see table 11 to table 14). Note that in the examples, it is assumed that present productive conditions will be maintained in the future if the project does not intervene (i.e., WOP scenario remains static over time).

The maize crop model and budget, presented in table 11, show how current annual yields of 1,700 kg/ha

TABLE 11

Maize crop model and budget

Maize – 1 ha Yields and inputs (per ha)	Unit	Existing technology	New technology		
		1 to 20	1	2	3 to 20
Main production					
maize	kg	1,700	1,800	1,900	2,000
Operating					
Inputs					
maize seeds	kg	35	35	35	35
fertilizer	kg	–	75	75	75
chemicals	kg	–	1	1	1
sack	unit	8	10	10	10
Labour					
operating unskilled labour	pers. day	41	45	45	45

Maize – 1 ha Financial budget (in $ per ha)	Price ($/unit)	Existing technology	New technology		
		1 to 20	1	2	3 to 20
Main production					
maize	0.23	382.5	405.0	427.5	450.0
Operating					
Inputs					
maize seeds	0.37	13.1	13.1	13.1	13.1
fertilizer	0.22	–	16.5	16.5	16.5
chemicals	5.00	–	5.0	5.0	5.0
sack	0.40	3.2	4.0	4.0	4.0
Subtotal input costs		*16.3*	*38.6*	*38.6*	*38.6*
Income (before labour costs)		**366.2**	**366.4**	**388.9**	**411.4**
Labour costs					
operating unskilled labour	2.00	82.0	90.0	90.0	90.0
Income (after labour costs)		**284.2**	**276.4**	**298.9**	**321.4**

will increase by 18 per cent to 2,000 kg/ha yearly, after three years of implementing improved production techniques – that is, using fertilizers and pesticides.

Table 12 shows the productive technical parameters (crop model and budget) for 1 ha of cassava. Here, the introduction of 1 kg of pesticide per ha is expected to gradually result in a 30 per cent increase in productivity after five years.

The banana crop model and budget (table 13) illustrate the technical proposal of introducing more productive banana varieties and improved production techniques. In addition to fertilizers and pesticides, 700 new plants will be introduced; after five years, they will result in a 33 per cent increase in productivity per ha.

TABLE 12

Cassava crop model and budget

Cassava – 1 ha Yields and inputs (per ha)	Unit	Existing technology	New technology				
		1 to 20	1	2	3	4	5 to 20
Main production							
cassava	kg	7,000	7,000	7,500	8,000	8,500	9,000
Operating							
Inputs							
cassava cuttings	plants	8	8	10	10	10	10
chemicals	kg	–	1	1	1	1	1
Labour							
operating unskilled labour	pers. day	72	78	78	78	78	78

Cassava – 1 ha Financial budget (in $ per ha)	Price ($/unit)	Existing technology	New technology				
		1 to 20	1	2	3	4	5 to 20
Main production							
cassava	0.10	700.0	700.0	750.0	800.0	850.0	900.0
Operating							
Inputs							
cassava cuttings	0.95	7.6	7.6	9.5	9.5	9.5	9.5
chemicals	5.00	–	5.0	5.0	5.0	5.0	5.0
Subtotal Input costs		*7.6*	*12.6*	*14.5*	*14.5*	*14.5*	*14.5*
Income (before labour costs)		**692.4**	**687.4**	**735.5**	**785.5**	**835.5**	**885.5**
Labour costs							
operating unskilled labour	2.00	144.0	156.0	156.0	156.0	156.0	156.0
Income (after labour costs)		**548.4**	**531.4**	**579.5**	**629.5**	**679.5**	**729.5**

TABLE 13

Banana crop model and budget

Banana – 1 ha Yields and inputs (per ha)	Unit	Existing technology	New technology				
		1 to 20	1	2	3	4	5 to 20
Main production							
banana	kg	6,000	–	6,500	7,000	7,500	8,000
Investment							
Inputs							
banana suckers (new)	plants	–	700	–	–	–	–
fertilizer	kg	–	25	–	–	–	–
chemicals	kg	–	1	–	–	–	–
Labour							
investment unskilled labour	pers. day	–	10	–	–	–	–
Operating							
Inputs							
banana suckers (existing)	plants	70	–	–	–	–	–
banana suckers (new)	plants	–	–	150	150	150	150
fertilizer	kg	–	–	50	50	50	50
chemicals	kg	–	–	2	2	2	2
Labour							
operating unskilled labour	pers. day	50	–	70	70	70	70

Banana – 1 ha Financial budget (in $ per ha)	Price ($/unit)	Existing technology	New technology				
		1 to 20	1	2	3	4	5 to 20
Main production							
banana	0.20	1,200.0	–	1,300.0	1,400.0	1,500.0	1,600.0
Input							
Investment							
banana suckers (new)	0.03	–	21.0	–	–	–	–
fertilizer	0.22	–	5.5	–	–	–	–
chemicals	5.00	–	5.0	–	–	–	–
Subtotal investment			*31.5*	–	–	–	–
Operating							
banana suckers (existing)	0.03	2.1	–	–	–	–	–
banana suckers (new)	0.03	–	–	4.5	4.5	4.5	4.5
fertilizer	0.22	–	–	11.0	11.0	11.0	11.0
chemicals	5.00	–	–	10.0	10.0	10.0	10.0
Subtotal operating		*2.1*	–	*25.5*	*25.5*	*25.5*	*25.5*
Subtotal inputs		**2.1**	**31.5**	**25.5**	**25.5**	**25.5**	**25.5**
Income (before labour costs)		**1,197.9**	**-31.5**	**1,274.5**	**1,374.5**	**1,474.5**	**1,574.5**
Labour							
Investment							
investment unskilled labour	2.00	–	20.0	–	–	–	–
Operating							
operating unskilled labour	2.00	100.0	–	140.0	140.0	140.0	140.0
Subtotal labour		**100.0**	**20.0**	**140.0**	**140.0**	**140.0**	**140.0**
Income (after labour costs)		**1,097.9**	**-51.5**	**1,134.5**	**1,234.5**	**1,334.5**	**1,434.5**

The inclusion of coffee as an additional cash crop is reflected in table 14. Here the WOP scenario is equal to zero, as the hills where this crop will be introduced are not now being used for productive purposes. However, when the farm models are developed in the next step of the analysis, the WOP situation will realistically reflect how farmers are using their time and resources today in comparison with the project proposal.

As the crop model shows, the coffee plants will take four years to start producing revenues, and this will happen gradually. The crop budget seems to reveal that, if farmers living in subsistence conditions are to adopt this crop, they will most probably need some initial support to face the huge investment costs and financial deficit that are produced during the first years when no revenues are generated.

However, crop budgets are not enough to realistically reflect farmers' situations. As will be shown in the next section, farmers' production systems (the size of their plots, the distributions of crops and livestock, and the composition of their household, as well as their off-farm incomes) are what will determine their real production capacities and related cash flows. As an example, while coffee may be not producing enough during a certain period, revenues from other crops may be enough to cover for this gap, depending on the size and productivity of the rest of the plot.

TABLE 14

Coffee crop model and budget

Coffee – Yields and inputs (per ha)	Unit	Without project	New technology								
			1	2	3	4	5	6	7	8	9 to 20
Main production											
coffee	kg	–	–	–	–	450	500	550	600	650	700
Investment											
Inputs											
coffee seedlings	plant	–	1,750	200	200	–	–	–	–	–	–
fertilizer	kg	–	200	200	200	–	–	–	–	–	–
land preparation	ha	–	1	–	–	–	–	–	–	–	–
Labour											
lining and holing	pers. day	–	20	2	2	–	–	–	–	–	–
transport	pers. day	–	15	2	2	–	–	–	–	–	–
pruning	pers. day	–	10	10	2	–	–	–	–	–	–
fertilization	pers. day	–	2	2	2	–	–	–	–	–	–
Subtotal		–	*47*	*16*	*8*	–	–	–	–	–	–
Operating											
Inputs											
fertilizer	kg	–	50	75	100	100	100	100	100	100	100
chemicals	kg	–	–	–	–	5	5	5	5	5	5
Labour											
weeding	pers. day	–	36	36	36	36	36	36	36	36	36
chemical application	pers. day	–	–	–	–	4	4	4	4	4	4
fertilizer application	pers. day	–	1	1	2	2	2	2	2	2	2
pruning	pers. day	–	–	–	1	2	2	2	2	2	2
harvest	pers. day	–	–	–	–	28	28	28	28	28	28
processing	pers. day	–	–	–	–	3	3	3	3	3	3
transport	pers. day	–	–	–	–	3	3	3	3	3	3
Subtotal		–	*37*	*37*	*39*	*78*	*78*	*78*	*78*	*78*	*78*

TABLE 14 **Coffee crop model and budget** (cont.)

Coffee – Financial budget (in $ per ha)	Price ($/unit)	Without project	New technology								
			1	2	3	4	5	6	7	8	9 to 20
Main production											
coffee	1.89	–	–	–	–	850.5	945.0	1,039.5	1,134.0	1,228.5	1,323.0
Inputs costs											
Investment coffee seedlings	0.20	–	350.0	40.0	40.0	–	–	–	–	–	–
fertilizer	0.22	–	44.0	44.0	44.0	–	–	–	–	–	–
land preparation	90.00	–	90.0	–	–	–	–	–	–	–	–
Subtotal investment			*484.0*	*84.0*	*84.0*		–	–	–	–	–
Operating fertilizer	0.22	–	11.0	16.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0
chemicals	5.00	–	–	–	–	25.0	25.0	25.0	25.0	25.0	25.0
Subtotal operating inputs		–	*11.0*	*16.5*	*22.0*	*47.0*	*47.0*	*47.0*	*47.0*	*47.0*	*47.0*
Subtotal inputs costs		**–**	**495.0**	**100.5**	**106.0**	**47.0**	**47.0**	**47.0**	**47.0**	**47.0**	**47.0**
Income (before labour costs)		**–**	**-495.0**	**-100.5**	**-106.0**	**803.5**	**898.0**	**992.5**	**1,087.0**	**1,181.5**	**1,276.0**
Labour											
Investment lining and holing	2.00	–	40.0	4.0	4.0	–	–	–	–	–	–
transport	2.00	–	30.0	4.0	4.0	–	–	–	–	–	–
pruning	2.00	–	20.0	20.0	4.0	–	–	–	–	–	–
fertilization	2.00	–	4.0	4.0	4.0	–	–	–	–	–	–
Subtotal investment		–	*94.0*	*32.0*	*16.0*	–	–	–	–	–	–
Operating weeding	2.00	–	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0
chemical application	2.00	–	–	–	–	8.0	8.0	8.0	8.0	8.0	8.0
fertilizer application	2.00	–	2.0	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
pruning	2.00	–	–	–	2.0	4.0	4.0	4.0	4.0	4.0	4.0
harvest	2.00	–	–	–	–	56.0	56.0	56.0	56.0	56.0	56.0
processing	2.00	–	–	–	–	6.0	6.0	6.0	6.0	6.0	6.0
transport	2.00	–	–	–	–	6.0	6.0	6.0	6.0	6.0	6.0
Subtotal operating		–	*74.0*	*74.0*	*78.0*	*156.0*	*156.0*	*156.0*	*156.0*	*156.0*	*156.0*
Subtotal labour costs		**–**	**168.0**	**106.0**	**94.0**	**156.0**	**156.0**	**156.0**	**156.0**	**156.0**	**156.0**
Income (after labour costs)		**–**	**-663.0**	**-206.5**	**-200.0**	**647.5**	**742.0**	**836.5**	**931.0**	**1,025.5**	**1,120.0**

Farm models

Now that the basic technical and financial information has been collected, the analyst should review the agrarian structure in the project area, identify the different sizes of farms and the use of land in each of them, and prepare "representative farm models" that would illustrate the present and the WOP situations.

Any additional information about the farm system – off-farm activities, size of household, number of working members and so on – will improve this step of the analysis. Once the farm models have been developed, the agronomist and other experts use them to formulate the best technical proposal to build up the WP scenario.

In our example, only one farm model (the *coffee model/farm*) will be developed.[48] This 8-ha farm includes the production of four crops: maize, cassava, banana and a new crop – coffee. Approximately 2,000 potential beneficiaries of the project may be represented through a model presenting such characteristics.[49]

a. Cropping patterns

Table 15 shows the cropping patterns and land use of the coffee farm in the WOP and WP situations. Describing changes in cropping patterns and land use may result in a simple description of shifting crops when new technologies will replace the old ones in the next cycle, but agriculture is not always such a simple business. Many crops are not 100 per cent productive from the start, and they reach their full development only several years after their first planting. Thus, the analysis needs to take into consideration the phasing of expected benefits and land use patterns during the shifting period.

In table 15, the area under cultivation in the WOP situation has been assumed to be 2.5 ha, leaving 5.5 ha without cropping. The WP situation proposes to increase the cropping intensity of existing crops and to gradually introduce a 3.5-ha coffee plantation, reaching a total of 7 ha of cultivated area. This technical proposal implies, in addition to a new crop, the introduction of better technologies and consequent increases in productivity for all crops.

TABLE 15

Coffee farm – cropping patterns

Coffee farm cropping patterns (in ha)	Unit	Without project	With project			
		1 to 20	1	2	3	4 to 20
Cropping intensity	percent	31%	44%	63%	75%	88%
Cropping pattern						
Existing technology						
Maize crop	ha	0.5	–	–	–	–
Cassava	ha	0.5	–	–	–	–
Banana	ha	1.5	1.0	0.5	–	–
Subtotal existing technology		*2.5*	*1.0*	*0.5*	–	–
New technology						
Maize crop	ha	–	0.5	1.0	1.0	1.0
Cassava	ha	–	0.5	0.5	0.5	0.5
Banana	ha	–	0.5	1.0	1.5	1.5
Coffee	ha	–	1.0	2.0	3.0	4.0
Subtotal new technology		–	*2.5*	*4.5*	*6.0*	*7.0*
Total cropped area	**ha**	**2.5**	**3.5**	**5.0**	**6.0**	**7.0**

48 It is assumed that the farm has no other incomes outside the main productive activity. Off-farm incomes are very difficult to assess because of their informal and temporary nature (seasonal rural employment; services performed by women in the household, cooking, washing, sewing, etc.).

49 This example is an extreme simplification of typical situations in the real world (as well as in the IFAD "world" of projects). For example, a recent project in India (Jharkhand Tribal Empowerment and Livelihoods Project) included nine farm models formulated on the basis of 38 crop and activity models that covered 136,000 beneficiaries; in Mexico, the Territory Development Project in the Mixteca Region, approved in 2011, included 25 crop and activity models and 20 farm models that represented 17,500 beneficiaries. The selection of this example is for the sake of clarity in the exposition of the methods to use in undertaking EFA.

b. Farm yields and production costs

Table 16 presents the expected results of the farm model in physical terms. To reach these results, a careful and detailed aggregation and phasing of expected changes in yields and production costs must be carried out. This is shown in the steps between here and table 21.

In practical terms, all parameters described in the crop models (which correspond to 1 ha) need to be adjusted to the cropping patterns described in table 15. This may appear to be a simple task, but it can become very complex, as a couple of examples will clarify.

For cassava, for example, the parameters for the WOP and WP should be reduced to half, as cassava is only planted in 0.5 ha in the WOP and improved techniques (fertilizers and pesticides) will be applied only to the existing areas. Nonetheless, the analyst needs to be extremely accurate in respecting the gradual increment in yields that results from improved practices. In table 16, the upper part shows cropping patterns, and in the lower part the technical parameters are multiplied by the area (ha) that will actually be used for those purposes. During the first year, the existing 0.5 ha will yield the same quantities as in the WOP (3,500 kg), and the yield will gradually increase to 3,750, 4,000, and 4,250 kg in the following years until finally reaching full development in year 5 at 4,500 kg. This is one of the simplest cases.

For banana, old banana trees will be gradually replaced by new ones. The complexity here is that, during the first two years, both old and new trees are productive, but they have different productivity levels (see table 17). Total farm revenues need to consider both, as reflected in the line "Total banana production". As a matter of fact, the existing banana and the new banana are two different crops, even when the product is the same.

TABLE 16

Cassava crop model and budget applied to the cropping pattern of the farm model

Cassava yields (per ha) and farm model production	Unit	Without project	With project				
		1 to 20	1	2	3	4	5 to 20
Cropping pattern							
Existing technology							
Cassava	ha	0.5	–	–	–	–	–
New technology							
Cassava	ha	–	0.5	0.5	0.5	0.5	0.5
Yields – 1 ha							
Existing technology							
Cassava	kg/ha	7,000	7,000	7,000	7,000	7,000	7,000
New technology							
Cassava	kg/ha	–	7,000	7,500	8,000	8,500	9,000
Farm model production							
Existing technology							
Cassava	kg	3,500	–	–	–	–	–
New technology							
Cassava	kg	–	3,500	3,750	4,000	4,250	4,500
Total cassava production	**kg**	**3,500**	**3,500**	**3,750**	**4,000**	**4,250**	**4,500**

TABLE 17

Banana crop model applied to the cropping pattern of the farm model

Banana yields (per ha) and farm model production	Unit	Without project	With project						
		1 to 20	1	2	3	4	5	6	7 to 20
Cropping pattern									
Existing technology									
Banana (existing)	ha	1.5	1.0	0.5	–	–	–	–	–
New technology									
Banana (new)	ha	–	0.5	1.0	1.5	1.5	1.5	1.5	1.5
Yields – 1 ha									
Existing technology									
Banana (existing)	kg/ha	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
New technology									
Banana (new)	kg/ha	-	-	6,500	7,000	7,500	8,000	8,000	8,000
Farm model production									
Existing technology									
Banana (existing)	kg	9,000	6,000	3,000	–	–	–	–	–
New technology									
Banana (new) – 0.5 ha	kg	–	–	3,250	3,500	3,750	4,000	4,000	4,000
Banana (new) – 0.5 ha	kg	–	–	–	3,250	3,500	3,750	4,000	4,000
Banana (new) – 0.5 ha	kg	–	–	–	–	3,250	3,500	3,750	4,000
Total banana production	**kg**	**9,000**	**6,000**	**6,250**	**6,750**	**10,500**	**11,250**	**11,750**	**12,000**

In addition, even if in the third year all new banana trees have replaced the old ones, full productivity levels are reached only in year 7, when the trees planted in year 3 are finally producing at full development. This is illustrated by the phased calculation of WP yields for the farm model.

Table 16 and table 17 show how the calculation of yields and production from crop to farm models should be done. The same process is valid also for the inclusion of maize and for the calculation of all inputs, both for investment and operation, including labour requirements.

The input costs will also need to be phased, if they are related to crops that take time to develop – as for coffee seedlings (see table 18).

TABLE 18

Coffee crop model calculation for input requirements

Coffee inputs (per ha) and farm model inputs	Unit	Without project	With project						
		1 to 20	1	2	3	4	5	6	7 to 20
Cropping pattern									
New technology									
coffee	ha	–	1.0	2.0	3.0	4.0	4.0	4.0	4.0
Inputs – 1 ha									
New technology									
Investment									
Inputs									
coffee seedlings	plant	–	1,750	200	200	–	–	–	–
Inputs – farm model									
Investment									
Inputs									
coffee seedlings – 1 ha	plant	–	1,750	200	200	–	–	–	–
coffee seedlings – 1 ha	plant	–	–	1,750	200	200	–	–	–
coffee seedlings – 1 ha	plant	–	–	–	1,750	200	200	–	–
coffee seedlings – 1 ha	plant	–	–	–	–	1,750	200	200	–
Subtotal coffee seedlings	*plant*	–	*1,750*	*1,950*	*2,150*	*2,150*	*400*	*200*	–

Table 19 shows the final results of these calculations for all crops, in term of physical parameters, while table 21 and table 22 show financial results (farm budget).

In table 19 we can see, in addition to the new equipment, the increments in the quantities of purchased inputs (mainly fertilizers and chemicals) in the WP situation as well as the requirements of investments due to the new plantations of banana and coffee. Similarly, we can also see the increases in the volume of production of the different crops.

TABLE 19

Coffee farm model – WOP and WP production and input requirements

Coffee – Yields and inputs (per farm)	Unit	Without project	With project											
		1 to 20	1	2	3	4	5	6	7	8	9	10	11	12 to 20
PRODUCTION														
Maize	kg	850	900	1,900	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Cassava	kg	3,500	3,500	3,750	4,000	4,250	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Banana (existing + new)	kg	9,000	6,000	6,250	6,750	10,500	11,250	11,750	12,000	12,000	12,000	12,000	12,000	12,000
Coffee	kg	–	–	–	–	450	950	1,500	2,100	2,300	2,500	2,650	2,750	2,800
INPUTS														
Investment														
Banana														
banana suckers (new)	plants	–	350	350	350	–	–	–	–	–	–	–	–	–
fertilizer (new)	kg	–	12.5	12.5	12.5	–	–	–	–	–	–	–	–	–
chemicals	kg	–	0.5	0.5	0.5	–	–	–	–	–	–	–	–	–
Coffee														
coffee seedlings	plants	–	1,750	1,950	2,150	2,150	400	200	–	–	–	–	–	–
fertilizer	kg	–	200	400	600	600	400	200	–	–	–	–	–	–
land preparation	ha	–	1	1	1	1	–	–	–	–	–	–	–	–
Farm														
farm equipment	lump sum	–	1	1	1	–	–	–	–	–	–	–	–	–
Operating														
Maize														
maize seeds	kg	17.5	17.5	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
fertilizer	kg	–	37.5	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
chemicals	kg	–	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
sack	unit	4	5	10	10	10	10	10	10	10	10	10	10	10
Cassava														
cassava cuttings	plants	4	4	5	5	5	5	5	5	5	5	5	5	5
chemicals	kg	–	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Banana existing														
banana suckers (existing)	plants	105.0	70.0	35.0	–	–	–	–	–	–	–	–	–	–
Banana new														
banana suckers (new)	plants	–	–	75	150	225	225	225	225	225	225	225	225	225
fertilizer (new)	kg	–	–	25.0	50.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
chemicals (new)	kg	–	–	1.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Coffee														
fertilizer	kg	–	50.0	125.0	225.0	325.0	375.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
chemicals	kg	–	–	–	–	5.0	10.0	15.0	20.0	20.0	20.0	20.0	20.0	20.0

TABLE 19 **Coffee farm model – WOP and WP production and input requirements** (cont.)

Coffee – Yields and inputs (per farm)	Unit	Without project	With project											
		1 to 20	1	2	3	4	5	6	7	8	9	10	11	12 to 20
LABOUR														
Investment														
Banana investment unskilled labour	pers. day	–	5	5	5	–	–	–	–	–	–	–	–	–
Coffee investment unskilled labour	pers. day	–	47	63	71	71	24	8	–	–	–	–	–	–
Subtotal investment labour	**pers. day**	**–**	**52**	**68**	**76**	**71**	**24**	**8**	**–**	**–**	**–**	**–**	**–**	**–**
Operating														
Maize operating unskilled labour	pers. day	21	23	45	45	45	45	45	45	45	45	45	45	45
Cassava operating unskilled labour	pers. day	36	39	39	39	39	39	39	39	39	39	39	39	39
Banana existing operating unskilled labour	pers. day	75	50	25	–	–	–	–	–	–	–	–	–	–
Banana new operating unskilled labour	pers. day	–	–	35	70	105	105	105	105	105	105	105	105	105
Coffee operating unskilled labour	pers. day	–	37	74	113	191	232	273	312	312	312	312	312	312
Subtotal operating labour	**pers. day**	**132**	**149**	**218**	**267**	**380**	**421**	**462**	**501**	**501**	**501**	**501**	**501**	**501**

TABLE 20
Labour requirements

Labour budget	Unit	Without project	With project						
		1 to 20	1	2	3	4	5	6	7
Labour requirements									
Unskilled labour for investments	pers. day	–	52	68	76	71	24	8	–
Unskilled labour for operating	pers. day	132	149	218	267	380	421	462	501
Subtotal labour requirements	**pers. day**	**132**	**201**	**286**	**343**	**451**	**445**	**470**	**501**
Family labour available	pers. day	450	450	450	450	450	450	450	450
Hired labour									
Unskilled labour for investments[a]	pers. day	–	52	68	76	71	24	8	–
Unskilled labour for operating		–	–	–	–	–	–	12	51
Subtotal hired labour	**pers. day**	**–**	**52**	**68**	**76**	**71**	**24**	**20**	**51**
Family labour use	**pers. day**	**132**	**149**	**218**	**267**	**380**	**421**	**450**	**450**

[a] All unskilled labour for investment is hired.

Labour requirements. The analysis of labour requirements (table 20) will provide information on the availability of family labour and the need to hire workers, and therefore the employment opportunities generated by the project. In this specific case, the labour requirements do not exceed family labour availability until year 7. However, unskilled labour for investments from years 1 to 6 must be hired labour, for technical reasons. After year 7, labour requirements exceed family labour availability.

Farm budget. With all these elements, it is now possible to formulate farm budgets that are the basic tool to analyse the financial viability (i.e., profitability) and financial sustainability of the technical proposal – that is, the attractiveness of the technical proposal from the point of view of the beneficiaries. In practical terms, this is the valuation of all physical parameters by their market prices.

In our example, the coffee farm budget shown in table 21 and table 22 provides all the information needed to assess whether the farmer **should**, **could** and **would** invest in the new technology.

To analyse the different items of the financial budget, it is important to bear in mind that **this is not a "liquidity analysis" and the flows included are both "monetary" and "in-kind" flows.** For example, family labour[50] flows do not imply monetary disbursements, nor does family self-consumption of cassava or maize. But both must be considered in the analysis, as from the farmer's point of view these are key parameters for him to decide whether he **could** and **would** engage in the new production system.

50 The "family labour" availability has been estimated at 450 man-days per year with a total cost of $900 per year.

TABLE 21

Farm budget (WOP and WP situations)

Coffee farm – Financial budget (in $ per farm)	Without project	With project				With project							
	1 to 20	1	2	3	4	5	6	7	8	9	10	11	12 to 20
PRODUCTION													
Maize	191.3	202.5	427.5	450.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0
Cassava	350.0	350.0	375.0	400.0	425.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0
Banana (existing + new)	1,800.0	1,200.0	1,250.0	1,350.0	2,100.0	2,250.0	2,350.0	2,400.0	2,400.0	2,400.0	2,400.0	2,400.0	2,400.0
Coffee	–	–	–	–	850.5	1,795.5	2,835.0	3,969.0	4,347.0	4,725.0	5,008.5	5,197.5	5,292.0
Total production	**2,341.3**	**1,752.5**	**2,052.5**	**2,200.0**	**3,825.5**	**4,945.5**	**6,085.0**	**7,269.0**	**7,647.0**	**8,025.0**	**8,308.5**	**8,497.5**	**8,592.0**
PRODUTION COSTS													
Investment													
Purchased inputs fertilizer	–	46.8	90.8	134.8	132.0	88.0	44.0	–	–	–	–	–	–
chemicals	–	2.5	2.5	2.5	–	–	–	–	–	–	–	–	–
banana suckers	–	10.5	10.5	10.5	–	–	–	–	–	–	–	–	–
coffee seedlings	–	350.0	390.0	430.0	430.0	80.0	40.0	–	–	–	–	–	–
land preparation	–	90.0	90.0	90.0	90.0	–	–	–	–	–	–	–	–
farm equipmemt	–	3,500.0	1,500.0	595.0	–	–	–	–	–	–	–	–	–
Subtotal purchased inputs	–	*3,999.8*	*2,083.8*	*1,262.8*	*652.0*	*168.0*	*84.0*	–	–	–	–	–	–
Hired labour Investment unskilled labour	–	104.0	136.0	152.0	142.0	48.0	16.0	–	–	–	–	–	–
Subtotal investment costs	–	**4,103.8**	**2,219.8**	**1,414.8**	**794.0**	**216.0**	**100.0**	–	–	–	–	–	–
Operating													
Purchased inputs maize seeds	6.5	6.5	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1
cassava cuttings	3.8	3.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
fertilizer	–	19.3	49.5	77.0	104.5	115.5	121.0	121.0	121.0	121.0	121.0	121.0	121.0
chemicals	–	5.0	12.5	17.5	47.5	72.5	97.5	122.5	122.5	122.5	122.5	122.5	122.5
sack	1.6	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
banana suckers	3.2	2.1	3.3	4.5	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Subtotal purchased inputs	*15.1*	*38.7*	*87.1*	*120.8*	*180.6*	*216.6*	*247.1*	*272.1*	*272.1*	*272.1*	*272.1*	*272.1*	*272.1*
Hired labour Operating unskilled labour	263.0	297.0	436.0	534.0	760.0	842.0	924.0	1,002.0	1,002.0	1,002.0	1,002.0	1,002.0	1,002.0
Subtotal operating costs	**278.1**	**335.7**	**523.1**	**654.8**	**940.6**	**1,058.6**	**1,171.1**	**1,274.1**	**1,274.1**	**1,274.1**	**1,274.1**	**1,274.1**	**1,274.1**
Total production cost	**278.1**	**4,439.4**	**2,742.9**	**2,069.6**	**1,734.6**	**1,274.6**	**1,271.1**	**1,274.1**	**1,274.1**	**1,274.1**	**1,274.1**	**1,274.1**	**1,274.1**
Net benefits before financing	**2,063.2**	**-2,686.9**	**-690.4**	**130.4**	**2,090.9**	**3,670.9**	**4,813.9**	**5,994.9**	**6,372.9**	**6,750.9**	**7,034.4**	**7,223.4**	**7,317.9**

Each column of table 21 is, conceptually, an **income statement**[51] of the farm for a given year. In fact, only the WOP column can properly be defined in this way, because all the other columns are projections of farm income statements. The basic reason for this way of arranging the pertinent data is to calculate the annual net benefits (NB) (i.e., the earnings). The NB are calculated by matching every year's expected revenues with its expenses, regardless of how these flows are financed. In fact, the last row of table 21 is called "Net benefits before financing".

51 Farm income yearly analysis according to Gittinger (1982).

TABLE 22
Farm budget (incremental)

Farm model – Net incremental benefit (in $)		Without project	With project				With project							
		1 to 20	1	2	3	4	5	6	7	8	9	10	11	12 to 20
Incremental production														
Total production	$	2,341.3	1,752.5	2,052.5	2,200.0	3,825.5	4,945.5	6,085.0	7,269.0	7,647.0	8,025.0	8,308.5	8,497.5	8,592.0
Incremental production	**$**	**–**	**-588.8**	**-288.8**	**-141.3**	**1,484.3**	**2,604.3**	**3,743.8**	**4,927.8**	**5,305.8**	**5,683.8**	**5,967.3**	**6,156.3**	**6,250.8**
Incremental cost														
Investment cost	$	–	4,103.8	2,219.8	1,414.8	794.0	216.0	100.0	–	–	–	–	–	–
Operating cost	$	278.1	335.7	523.1	654.8	940.6	1,058.6	1,171.1	1,274.1	1,274.1	1,274.1	1,274.1	1,274.1	1,274.1
Total production cost	$	278.1	4,439.4	2,742.9	2,069.6	1,734.6	1,274.6	1,271.1	1,274.1	1,274.1	1,274.1	1,274.1	1,274.1	1,274.1
Incremental cost	$	–	4,161.4	2,464.8	1,791.5	1,456.5	996.5	993.0	996.0	996.0	996.0	996.0	996.0	996.0
Net incremental benefit	**$**	**–**	**-4,750.1**	**-2,753.5**	**-1,932.7**	**27.8**	**1,607.8**	**2,750.8**	**3,931.8**	**4,309.8**	**4,687.8**	**4,971.3**	**5,160.3**	**5,254.8**
	FIRR =	**23.6%**												
	FNPV =	**$21,803**												

Table 22 is built by deducting the NB in the WOP situation from the results obtained in table 21 (i.e., the NB in the WP situation), obtaining the net incremental benefits (NIB) for each year of the projection. Remember that the "incremental approach" is the basic method for assessing any investment project. This is the flow of financial resources that should be analysed to determine the profitability of the new production system. Table 22 shows the total value added by the project, not only in terms of profits but also in terms of additional input requirements (investment and operating costs). If profitability indicators are positive, this will indicate that the proposed intervention is viable from a financial point of view and that it represents a better option than the present (WOP) situation.

Final considerations. Box 5 provides some important tips for performing the financial analysis of farm models.

BOX 5
Some tips for formulating the financial analysis of farm models

- Adopt realistic market prices for outputs and inputs: average prices (i.e., five-year period) should be used for the valuation of farm outputs and inputs.
- All prices should be converted to farmgate prices, using information gathered on site.
- Avoid including "sunk costs" in the WP situation.
- Do not include depreciation in the financial budget, to avoid double-counting investment costs.
- Use constant prices during the whole period of analysis, ignoring inflation. This will ensure that the price level system is maintained and that incremental results will depend on increased quantities. Forecasting nominal prices is very difficult, if not impossible.
- The financial analysis is not a "liquidity" analysis. Therefore, all inflows and outflows (monetary and in-kind) should be monetized.
- Self-consumption of part or all of the agricultural production should be valued at sales market prices.
- Family labour should also be valued at its market price.

To assess the attractiveness of the proposed investment to the potential beneficiaries, calculate the "financial profitability" of the proposed productive activities for the different types of beneficiaries.

SHOULD the farmer invest?

Profitability indicators. Calculating these indicators will help us answer the question of whether farmers **should** invest in the new production system. But, before any profitability indicator can be calculated, two key parameters need to be defined: the *period of discount* and the *discount rate*.

- **Period of discount.** In our example we used a 20-year period, or the financial life of the farm model. We chose this period because the investment period for a coffee plantation is long; it takes 11 years to reach full development. The discount period should be longer than the investment period – at least the period required for the last farm engaged in the project to reach full development – to obtain a balanced record of costs and benefits.
- **Financial discount rate.** The financial discount rate (FDR) is necessary for calculating FNPV, and it is the reference value when FIRR is used as a profitability indicator. In financial terms, it provides the *alternative* financial returns or opportunity costs to the investor. Therefore, the choice of this parameter is of crucial importance for assessing the profitability of a given investment project and making the investment decision. To reflect the profitability of a farm investment in a typical IFAD production-oriented project, the FDR should be a proxy of the interest rate that could be obtained by any potential beneficiaries (i.e., small farmers). Given the very scarce investment alternatives of the rural poor, the recommended FDR is the passive interest rate of the local banking sector – that is, the interest rate paid on savings accounts in the local banks.[52] In our example, 7 per cent is used as the FDR.

Now that these two parameters have been defined, it is possible to estimate the main financial profitability indicators for the coffee farm model in the Guideland project: **FIRR = 23.6%** and **FNPV = $21,803** (discount rate 7 per cent). With a positive FNPV and a FIRR higher than 7 per cent (considered as the opportunity cost of capital), it can be concluded that the proposed investment is convenient from a financial point of view, and hence would be profitable for the farmer, who should be advised to invest in the project.

52 This parameter is a proxy, since most IFAD beneficiaries have very limited or no access to banking services.

This analysis is made from the point of view of the farmer and, therefore, its conclusions provide information on the convenience of adopting the new technical proposals from the farmer's perspective. Nevertheless, the results are more useful for the analyst and the technical team in charge of formulating the project. As Gittinger has pointed out (1982): "We should note that, although the farm budgets… place a fair amount of stress on determining the net present value, the financial rate of return, and the net benefit-investment ratio to the farmer's own resources, these measures of project worth are in fact not very important to the farmer. It is probably fair to say that for most small farmers the concept of capital return hardly plays any part in their decision… Far more important to farmers is the actual amount of additional income they expect to receive". The pertinent question is, "Will farm families have an incremental income large enough to compensate them for the additional effort and risk they will incur?"

Therefore, extension service providers should present the results of the financial analysis of the farm in a different and simpler way to induce the farmers to adopt the proposed project and technologies – for example, using the streams of expected gross revenues or net benefits and comparing them with the present situation.

Nonetheless, the results on the profitability of the proposed project should be considered only as a necessary – but by no means sufficient – condition for the adoption of the new technologies included in the project. The effective adoption of the proposed intervention would depend on a set of additional requirements, discussed next.

COULD the farmer invest?

The next step will assess the technical, financial and institutional feasibility of the investment. Although it has been proved that the investment is financially viable (i.e., profitable), the analyst needs to ensure that the producer will be able to afford engaging in the new activity. This is the moment to get together with the rest of the design team and answer at least the following questions:

(a) Are required inputs locally available?
(b) Is family work enough to cover new labour requirements?
(c) Is land available and affordable?
(d) Is there an enabling business/policy environment to foster the proposed interventions?
(e) Are available financial resources sufficient to cover investment and incremental working capital needs?[53]

Table 19 and table 21 are key to answering these questions and assessing whether the farmer **could** afford the introduction of the new production system. By presenting all physical and financial prerequisites to set up the new activities, they provide a clear picture of the additional monetary and in-kind requirements. Table 20 clearly shows that the family will be unable to perform the required labour by itself and that in certain periods it will be necessary to hire external workers. Are such workers available locally? Does the family have sufficient resources to pay for them?

Table 21 and table 22 show that NB and NIB will (a) be negative in the first two years; (b) be positive in year 3 of the WP situation, but lower than the WOP situation; (iii) reach the level of net benefits of the WOP situation in year 4; and (iv) grow above WOP levels until year 12 (maximum yearly net benefit foreseen). There is a clear indication that financial requirements will have to be taken into account to ensure the adoption of the proposed project. Identifying beneficiaries' financial needs is a key aspect of the overall EFA and will ensure not only the feasibility of proposed intervention but also the sustainability of its implementation.

In light of the identified financial gap, a "financial sustainability analysis"[54] of the proposed improvements for each farm model should also be undertaken.

The financial sustainability analysis assists in identifying the financial resources necessary to set up and start implementing proposed activities (i.e.,

53 Questions about physical requirements in terms of labour, land and inputs should be answered through local consultations and, if any constraints are identified, they should be included in the project risk analysis.

54 As named in the EU Guide on Cost-Benefit Analysis of Investment Projects.

initial investments and incremental working capital requirements). It is crucial to elaborate and discuss the results of this analysis with the rest of the design team. Rural finance experts can provide/ask for a clear picture of existing financing institutions serving the target population or, if there are none in the area, they can advise on best practices in addressing these problems through project interventions. IFAD has wide experience in designing rural finance components/projects, including, for example, access to affordable credit, promotion of credit and saving schemes, special grants, and other types of rural financial services to cover the required investments in part or in full.[55]

But how can the analyst assess the farmers' financial needs? In the previous section, to reply to the question of whether the farmer **should** invest in the new proposal, we considered the value of all incremental benefits that were created through project activities. These are the same streams of benefits that are considered for the economic analysis, with some adjustments (table 21 and table 22).

Table 21 and table 22 show clearly that the farmers would need additional sources of financing if they were to adopt the proposed technology. First, table 21 shows that farmers will need an initial investment of $4,000 and cumulative additional investments of $4,250 for the next five years. In addition, operating costs per year would increase from $39 in year 1 to $272 in year 7. Moreover, from the farmer's point of view, the new production system will result in a decrease in net benefits during the first three years, because of a decrease in sales until new plants reach their full development. For three years, therefore, he/she will be making less money than at present and will have to take care of his/her family's needs with a reduced budget – which is not possible, since the present income level is already below the poverty line (assumed at $2,430 for a household of four members).

To assess the farmer's capacity to finance the adoption of the proposed technology, the analysis considers all financial cash inflows to and outflows from the farm. According to Gittinger (1982): "Even though we use the term 'cash flow', noncash elements enter the projection, including home-consumed production and payments and receipts in-kind. (The term was first applied to industrial investments, in which noncash elements are less common)". Different authors use different names for this type of analysis – cash flow analysis, statement of sources and uses of funds analysis, statement of sources and applications of funds, funds flow analysis, and so on – but conceptually their main objective is to identify, for each year of the project, the conditions that would ensure the financial balance of the farm.

Farm budgets are the basis for building up this type of analysis, but the data must be arranged in a different way. As a matter of fact, the NB figures coming out of the farm budgets (income statements) do not always give a useful or meaningful picture of how the farm/enterprise operates. It is evident that unless the farm has sufficient cash available to stay in business (pay for its operations) and has some surplus to feed the family, the business will not be sustainable. The survival of a farm business depends not only on profits, but perhaps more on its ability to face its financial needs, including paying its debts when they fall due.

How do we formulate a sound "statement of sources and uses of funds" for a small farm? The answer depends on the type of farm business and on a set of assumptions. For example, a dairy farm would have a permanent inflow of funds since milk is sold daily, while a coffee farm would have a significant inflow of funds only after the annual harvest. The combination of crops and other productive activities that characterize most farming systems in the world opens a wide range of possibilities. In addition, assumptions about such things as the needed carryover for facing working capital requirements, the amount and timing of family needs, and the effective date on which investment costs must be paid would all influence the development of this calculation procedure.

In general terms, the formulation of a statement of sources and uses of funds for a typical small farm

55 Smallholder farmers need access to a wide range of financial services to enhance their productivity and reach markets: savings to respond to external shocks and make investments over time; working capital to finance their production costs; investment capital and access to leasing and insurance; guarantee funds; and finally, liquidity for their normal and extraordinary household expenditures.

that is operated by a poor rural family should identify all relevant inflows and outflows for the year, taking into account the following assumptions.[56]

(a) The establishment of an income threshold equivalent to the NB of the WOP situation as a permanent item of the statement, named "family self-consumption". It is clear that farmers will not adopt any activity that would reduce their previous incomes, since they are already living under the poverty line.[57]

(b) Including in the current year a provision for carryover that is equivalent to the working capital requirement for the next year (see Gittinger, 1982).

(c) All transactions should be considered to fall at the end of the current accounting period. Therefore, all revenues and costs (investment and operating) are assumed to occur at the end of the current period (see Gittinger, 1982).

With these general assumptions, it is possible to formulate a statement of sources and uses of funds for the Guideland coffee farm, using the data in table 21. The basic objective of this tool is to identify the farm's cash flow before financing. If this result is negative for at least one year, the next step involves finding alternative ways of financing the gaps – by using available financing facilities (banks, financing funds, etc.), or by formulating additional options and/or combining them with current financing facilities. The idea is to achieve a cash flow after financing that is greater than zero in every year of the period under analysis.

Table 23 is the statement of sources and uses of funds for the coffee farm. It has been built following a traditional approach in which "family labour" is not detailed. Therefore, the farm cash flow before financing includes family labour remuneration as well as net benefits. In the WOP situation, this amount is totally consumed by the farmer family, and the cash flow is near zero. In the WP situation, the farm cash flow shows a deficit in the first two years while the cash flow before financing shows a larger deficit during the first three years.

The WOP situation is that of a poor rural family (poverty line equivalent to $2,430) that has no significant (if any) family savings that might finance the foreseen financial deficits. Also, the farmer will not adopt the proposed technology if he has to face future years with less income than in the WOP situation. Therefore, the farmer family cash flow is the pertinent information.

The statement of sources and uses of funds analysis has proven that the project proposal is not financially sustainable; to ensure the adoption of the proposed technology, it is necessary to look for additional financial resources. The next step is to assess whether local-level financial institutions could offer credit conditions appropriate to the farmer's needs. This is again an exercise performed in collaboration with the rural finance experts, who can also assist in designing an alternative financing scheme if necessary.[58]

For developing an alternative financing scheme, a credit analysis is required.[59] Let's suppose that

TABLE 23

Financial sustainability analysis – statement of sources and uses of funds

Coffee farm – Financial budget (in $ per farm)	With project											
	1	2	3	4	5	6	7	8	9	10	11	12 to 20
Inflows												
Value of production	1,753	2,053	2,200	3,826	4,946	6,085	7,269	7,647	8,025	8,309	8,498	8,592
Cash carryover from previous year												
Operating inputs	39	87	121	181	217	247	272	272	272	272	272	272
Family self-consumption	2,000	2,000	2,000	2,000	2,200	2,420	2,662	2,928	2,928	2,928	2,928	2,928
Subtotal cash carryover from previous year	*2,039*	*2,087*	*2,121*	*2,181*	*2,417*	*2,667*	*2,934*	*3,200*	*3,200*	*3,200*	*3,200*	*3,200*
Total inflows	**3,791**	**4,140**	**4,321**	**6,006**	**7,362**	**8,752**	**10,203**	**10,847**	**11,225**	**11,509**	**11,698**	**11,792**
Outflows												
Investment inputs costs	4,000	2,084	1,263	652	168	84	–	–	–	–	–	–
Operating inputs costs	39	87	121	181	217	247	272	272	272	272	272	272
Cash carryover for next year												
Operating inputs	87	121	181	217	247	272	272	272	272	272	272	272
Hired labour (investments + operating)[a]	136	152	142	48	16	–	–	–	–	–	–	–
Family self-consumption[b]	2,000	2,000	2,000	2,200	2,420	2,662	2,928	2,928	2,928	2,928	2,928	2,928
Subtotal cash carryover for next year	*2,223*	*2,273*	*2,323*	*2,465*	*2,683*	*2,934*	*3,200*	*3,200*	*3,200*	*3,200*	*3,200*	*3,200*
Total outflows	**6,262**	**4,444**	**3,706**	**3,297**	**3,068**	**3,265**	**3,472**	**3,472**	**3,472**	**3,472**	**3,472**	**3,472**
Cash flow before financing	**-2,470**	**-304**	**615**	**2,709**	**4,294**	**5,487**	**6,731**	**7,375**	**7,753**	**8,036**	**8,225**	**8,320**

[a] Investments and Operating that exceeds family labour available (450 days).
[b] Will increase 10 per cent by year, starting at PY4.

56 These assumptions might change if the actual operating conditions of the farm under analysis would require it: (e.g., in the dairy farm). In this case, family needs would be financed by the current operations of the same year, and no provision for this item should be included.

57 This requirement is not necessary when analysing farmers with incomes over the poverty line. Their NB could be less than the WOP situation, generating a reduction of their "savings" without affecting their standard of living. See, for example, Gittinger, J.P. "Economic Analysis of Agricultural Projects".

58 For a complete reference on how to design a rural finance component, see IFAD Decision Toolkit for Rural Finance. https://www.ifad.org/documents/38714170/39144386/IFAD+Decision+Tools+for+Rural+Finance.pdf/67965f15-2388-4d23-8df6-aee97bade810. If interested in knowing on how to evaluate a rural finance component, please refer to IFAD's EFA Internal Guidelines Volume 3, pages 135-158.

59 Specific calculations are required to obtain the right results for the loan reimbursements and interests. The analyst should carefully undertake these calculations, which would also depend on specific financing alternatives: for example, equal or different instalments; "French" or "German" amortisation systems, etc.

TABLE 24
Guideland financing terms

	Long-term credit for investment	Short-term credit for operating
Repayment period	5 years + constant payments	180 days
Grace period	1 year	none
Percentage to finance	100%	60%
Interest rate	10%	10%

locally it is possible to find medium- or long-term credit facilities to help finance the proposed investments, as well as short-term funds to help finance incremental needs for working capital (100 per cent). Guideland's local banking/financing terms and conditions are shown in table 24. Given the available credit terms and conditions, the cash flow after financing would be lower than in the WOP situation during the first four years (table 25). Therefore, it is not feasible to finance the proposed investments only by accessing credit from existing financial institutions.

The project team meets again and this time decides to introduce a grant component to complete the financing package that would make the proposed project financially sustainable.[60] The grants would cover the total costs of the investments included in the farm model, while the incremental operating costs would be financed by short-term loans under local financial terms and conditions (table 26). The grant and credit analysis (table 26) shows that the cash flow after financing is positive and higher than in the WOP situation from the first years of the project.

TABLE 25
Financial sustainability analysis – credit analysis for investments and operating costs

Coffee farm – Statement of sources and use of funds (in $ per farm)	With project					With project						
	1	2	3	4	5	6	7	8	9	10	11	12 to 20
Inflows												
Value of production	1,753	2,053	2,200	3,826	4,946	6,085	7,269	7,647	8,025	8,309	8,498	8,592
Cash carryover from previous year	2,039	2,087	2,121	2,181	2,417	2,667	2,934	3,200	3,200	3,200	3,200	3,200
Long term credit for investment	4,000	2,084	1,263	–	–	–	–	–	–	–	–	–
Short term credit for operating	23	52	73	108	–	–	–	–	–	–	–	–
Total inflows	7,814	6,276	5,656	6,114	7,362	8,752	10,203	10,847	11,225	11,509	11,698	11,792
Outflows												
Investment inputs costs	4,000	2,084	1,263	652	168	84	–	–	–	–	–	–
Operating inputs costs	39	87	121	181	217	247	272	272	272	272	272	272
Hired labour	136	152	142	48	16	–	–	–	–	–	–	–
Cash carryover for next year												
Operating inputs	35	48	72	217	247	272	272	272	272	272	272	272
Hired labour (investments + operating)	136	152	142	48	16	–	–	–	–	–	–	–
Family self-consumption	2,000	2,000	2,000	2,200	2,420	2,662	2,928	2,928	2,928	2,928	2,928	2,928
Subtotal cash carryover for next year	2,171	2,200	2,214	2,465	2,683	2,934	3,200	3,200	3,200	3,200	3,200	3,200
Payments of loans												
Repayment of investment loan	–	–	800	1,217	1,469	1,469	1,469	669	253	–	–	–
Repayment of operating loan	–	23	52	73	108	–	–	–	–	–	–	–
Interest of investment loan	–	400	608	655	533	386	239	92	25	–	–	–
Interest of operating loan	–	1	3	4	5	–	–	–	–	–	–	–
Subtotal loans repayment	–	424	1,463	1,947	2,116	1,855	1,708	761	278	–	–	–
Total outflows	6,345	4,948	5,203	5,293	5,200	5,120	5,181	4,234	3,750	3,472	3,472	3,472
Cash flow after financing	1,469	1,328	453	822	2,163	3,632	5,023	6,613	7,475	8,036	8,225	8,320

Credit parameters	Long term credit for investment	Short term credit for operating
Repayment period	5 years + constant payments	180 days
Grace period	1 year	none
Percentage to finance	100%	60%
Interest rate	10%	10%

60 The grant solution is only one possible alternative, chosen in this case to facilitate the analysis and because the target group is extremely poor. Supporting access to a variety of financial services, including savings, credit remittances and insurance, is generally a more sustainable strategy. Grants should be one-off interventions to reduce the vulnerability of extremely poor people or promote the adoption of new technologies. Providing medium-term credit products developed by supporting existing financial service providers is another recommended strategy. Finally, deferred interest payment programs (for example, Patient Capital schemes) are also recommended. For more information, consult IFAD's rural finance policy.

TABLE 26

Financial sustainability analysis – grants for investments and short-term credit for operating costs

Coffee farm – Statement of sources and use of funds (in $ per farm)	With project					With project						
	1	2	3	4	5	6	7	8	9	10	11	12 to 20
Inflows												
Value of production	1,753	2,053	2,200	3,826	4,946	6,085	7,269	7,647	8,025	8,309	8,498	8,592
Cash carryover from previous year	2,039	2,087	2,121	2,181	2,417	2,667	2,934	3,200	3,200	3,200	3,200	3,200
Long-term credit for investment	4,000	2,084	1,263	–	–	–	–	–	–	–	–	–
Short-term credit for operating	23	52	73	108	–	–	–	–	–	–	–	–
Total inflows	7,814	6,276	5,656	6,114	7,362	8,752	10,203	10,847	11,225	11,509	11,698	11,792
Outflows												
Investment inputs costs	4,000	2,084	1,263	652	168	84	–	–	–	–	–	–
Operating inputs costs	39	87	121	181	217	247	272	272	272	272	272	272
Hired labour	136	152	142	48	16	–	–	–	–	–	–	–
Cash carryover for next year Operating inputs non-financed with short-term credit	35	48	72	217	247	272	272	272	272	272	272	272
Hired labour (investments + operating)	136	152	142	48	16	–	–	–	–	–	–	–
Family self-consumption	2,000	2,000	2,000	2,000	2,200	2,420	2,662	2,928	2,928	2,928	2,928	2,928
Subtotal cash carryover for next year	2,171	2,200	2,214	2,265	2,463	2,692	2,934	3,200	3,200	3,200	3,200	3,200
Payments of operating credit												
Repayment of operating credit	–	23	52	73	108	–	–	–	–	–	–	–
Interest of operating credit	–	1	3	4	5	–	–	–	–	–	–	–
Subtotal loans repayment	–	24	55	76	114	–	–	–	–	–	–	–
Total outflows	6,345	4,548	3,795	3,221	2,977	3,023	3,206	3,472	3,472	3,472	3,472	3,472
Cash flow after financing	1,469	1,728	1,861	2,893	4,385	5,729	6,997	7,375	7,753	8,036	8,225	8,320

Credit parameters	Short term credit for operating
Repayment period	180 days
Percentage to finance	60%
Interest rate	10%

Only now is it possible to state, on a sound technical and financial basis, that the project proposal would be attractive for the beneficiaries, ensuring a high rate of adoption of the proposed technology and therefore giving a solid reason to assume that the investment would yield the expected benefits.

A note of caution is necessary here, given that these results are based on the provision of a grant.[61] In all cases, both the financial sustainability and viability analyses should stimulate the design team's discussion of how to finance the incremental costs necessary to implement the proposed new technology. Do beneficiaries have enough financial resources? Do they have access to savings/credit/loan schemes? How sustainable is an approach based on grants alone? If the major bottleneck is the lack of long-term credit products in the country, how will the project help to remove this obstacle? Are there other interventions that the project could put in place to remove these barriers (e.g., facilitate access to finance for small-scale farmers by asking financial institutions to develop ad hoc financial products; guarantee schemes, etc.)?

Another question that arises from this analysis is whether project beneficiaries will be attractive customers for financial institutions that provide short-term credit. It is evident that beneficiaries lacking sufficient guarantees and living in remote areas far from the local branch services will imply higher operating costs. However, an alternative solution may be to link the provision of short-term credit to the opening of savings accounts. This approach is becoming more common and helps solve another issue faced by poor rural families: how to manage savings in difficult circumstances (unfavourable weather, difficult family situations, etc.), while improving saving habits.

61 Given the risks and the shortfalls associated with the establishment and management of grant facilities, including the risk of creating distortions in the market, in real life a very cautious approach should be followed (see IFAD's Technical Note on Matching Grants) and alternative long-term solutions analysed.

BOX 6

Summary of the Guideland project findings

The financial analysis conclusions showed that the project's technical proposals for improving the production and productivity conditions of the beneficiaries were not feasible: although they were profitable from a financial point of view, they were not financially viable.

The proposed financing scheme concluded that, given the lack of long-term credit facilities in the country, every farm participating in the project would need to access short-term credit products, build their asset base through savings, and be included in the grant scheme.

As a consequence, the original project structure should be complemented with a financial component that includes (a) savings mobilization and linkages with financial service providers (a relatively low-cost measure); and (b) an "investment fund" (entailing more significant costs) to administer all the required grants for investments and compensation for the low coffee production in the first five years.

The preparation of this new component requires the analysts to estimate the total amounts required for covering the 2,000 expected beneficiaries.

The answer to the question "COULD the farmer invest?" has been provided by the financial sustainability analysis and the reformulation of the proposed Guideland project.

WOULD the farmer invest?

What will convince rural stakeholders to change their practices and adopt the proposed new technologies? To answer the question "WOULD the farmer invest?", project teams should try to identify the elements that will increase the likelihood that beneficiaries will adopt the project proposals. In addition to the indicators of financial profitability and sustainability, it is useful to have information on indicators like return to family labour, returns per unit of land area, and family income in comparison with the income poverty line.

Return to family labour and returns per unit of land area. The following indicators are very useful: (a) comparison of labour returns (i.e., available family labour returns), and (b) comparison of returns per unit of land area. These indicators would always be consistent with the profitability indicators: that is to say, when NPV > 0, labour returns in the WP situation will be higher than in the WOP situation. Similarly, when there is no crop area expansion, returns per unit of land area in the WP situation will be higher than those in the WOP situation. The return to labour – for both the WOP and WP scenarios – can be calculated using the following formula:

$$\textit{Return to labour} = \frac{\textit{Net benefits}}{\textit{Family labour (days)}}$$

In the Guideland project example, the return to family labour before financing in the WOP situation is equivalent to $2,063/132 = $15 per man/day (data from table 20 and table 21). The family labour returns in the WP situation (at "project full development")[62] are estimated at $7,318/450 = $16.3 per man/day. The same indicator can be computed also for the after-financing scenario, providing a clearer indication of the impact on family welfare. In this case, the return to labour in the WP situation after financing will be equivalent to $8,320/450 = $18.5/day (data from table 26). In both the before- and after-financing scenarios, indicators have increased, thus justifying once more the proposed interventions.

Comparison of family incomes with the income poverty line. In addition, it is important to show the net family income in the WP situation at full development and compare it with other relevant indicators such as the income poverty line to make decisions about the convenience of the proposed alternative. For example, a proposed alternative might be profitable, but the absolute level of obtained incomes could mean that the household would still

62 The term "at full development" refers to the year at which the main project parameters (i.e., net benefits) reach their maximum values. In the Guideland project example, the project full development is reached in year 12.

be under the income poverty line. This should be an indicator for the project formulators to seek other productive alternatives that would ensure greater increases in income.

In the Guideland project example, the net family incomes at full project development reach the equivalent of $7,318 – an amount that is clearly higher than the income poverty line of $2,430.

To better clarify this point, we present information from the India Jharkhand Tribal Empowerment and Livelihoods Project financed by IFAD a few years ago:

TABLE 27

Summary of financial results per household by farm model

	Subproject	Gross income		Inputs		Net income	
		WOP	WP	WOP	WP	WOP	WP
1	Rainfed agriculture	741	2,545	258	510	483	2,035
2	Irrigated agriculture	23,876	50,511	9,921	14,420	13,955	36,091
3	Vegetable clusters	21,693	35,063	1,715	3,169	19,979	31,895
4	Mango orchard clusters	–	88,714	–	2,945	–	85,769
5	Tasar-coccon cluster – forest based	–	24,667	–	2,978	–	21,688
6	Tasar-coccon cluster – new plantation	–	24,444	–	3,233	–	21,211
7	Lac production clusters	–	16,500	–	5,534	–	10,966
8	Goat-rearing clusters	–	43,325	–	2,200	–	41,125
9	IGA interventions	–	17,207	–	3,458	–	13,749

Note: WP is at full development stage; Net income includes returns from family labour.

The absolute poverty line (US$360 per person per year) is equivalent to INR 18,000 per person. For households with a size equivalent to 3.5 adult persons, the absolute poverty line would be INR 63,000. In the WOP situation, the highest of the household incomes (the vegetables clusters) only reach 31 per cent of this figure, and in the WP situation, only one proposed activity (mango orchards) would achieve net incomes above the poverty line. All other proposed activities achieve net incomes below the poverty line, although significantly improving the WOP situation.[63]

Self-consumption and cash position (in monetary terms). In general, all small farmers keep part of their production for home self-consumption. The analyst should identify carefully the amount of self-consumption in the WOP situation and make sensible forecasts of these items during the proposed project life. Two issues are closely related to this matter: (a) the nutrition balance of the farmer family, and (b) the farmer's cash position (in monetary terms), especially when there are financial debts.

For example, in the Guideland project, the analyst found that in the WOP situation, the family consumption of maize is about 4 kg/day, the cassava consumption is 3 kg/day and the banana consumption reaches 1.5 kg/day. With these figures, the farmer's production of maize is not sufficient to cover home consumption.

In the WOP situation, the sales of cassava and banana are used to buy maize as well as other consumption items for the family livelihood. When analysing the WP situation, it is clear that family self-consumption of maize is covered by the farm production from year 2 of the project on (with a surplus of 27 per cent for sales). This food-sheet balance could be included in the analysis, including appropriate projections.

Use of cash flows after financing. The analysis of table 23 to table 26 also shows that the use of cash flows (before and after financing) is not completely defined. In fact, there is a defined use for covering "family self-consumption" at the WOP level (which is under the income poverty line), and the use of the balance is left undetermined.

A complete analysis should include a hypothesis for the use of the cash flows after financing. The simplest alternative is to add a new item, "change in family net worth", for all balances above the WOP "family needs", but this alternative would hide the use of increasing incomes up to a certain level. Since the main objective of the project is to increase the farmers' real incomes (hopefully reaching levels above the income poverty line), it is worth establishing an "income-level goal" and determining when it would be achieved. Once the income-level goal is achieved, the balances would clearly represent the accumulation of net family worth.

Table 28 shows the use of cash flows after financing for the coffee farm. During the first five years, all balances of cash after financing are intended to increase the real family consumption. Once the "income goal" is reached (equivalent, as an assumption, to two times the income poverty level), the balances will increase the family net worth. Family assets (financial or in-kind) would increase from then on. This is a typical indicator of project performance in project ex-post evaluation exercises.

In brief, the attractiveness of the investment (and project interventions) to the target group is clearly supported by the indicators given above. The analyst should prepare and clearly present this type of indicator to complement the financial profitability and sustainability analysis.

Economic analysis

This section deals with the elements to be considered when building the economic analysis from the financial farm and enterprise models, bringing these two perspectives together:

(a) **Aggregated economic cash flows from productive activities:** the cumulative value of all the NIBs accrued from farm/activity models involved in the project, expressed in economic values.

(b) **Aggregated cash flows from other, less tangible, activities** such as long-term benefits from adaptation to climate change; direct impacts on the farm from the construction or improvement of rural roads, on- and off-farm benefits from water and sanitation infrastructure, and so on.

TABLE 28
Use of cash flows after financing

Coffee farm – Use of cash flows after financing (in $ per farm)	With project					With project						
	1	2	3	4	5	6	7	8	9	10	11	12 to 20
Cash flow after financing	**1,469**	**1,728**	**1,861**	**2,893**	**4,385**	**5,729**	**6,997**	**7,375**	**7,753**	**8,036**	**8,225**	**8,320**
Covering increasing family needs[a]	1,469	1,728	1,861	2,893	4,385	4,385	4,385	4,385	4,385	4,385	4,385	4,385
Changes in family net worth	**–**	**–**	**–**	**–**	**–**	**1,344**	**2,612**	**2,990**	**3,368**	**3,652**	**3,841**	**3,935**

[a] Up to two times the Income poverty line.

63 It is very likely that, in this case, the households receive off-farm incomes that have not been properly recorded. It is a useful example to show the convenience of preparing rural household models to properly describe the present and WOP situation, taking these off-farm incomes into account.

(c) **Cash flows from project externalities** (positive and negative): indirect or unexpected impacts of on-farm practices; indirect impacts of access to improved infrastructure (roads, sanitation, etc.).

(d) **Economic project costs:** those costs that are not included in the farm budgets (for example, costs of extension services, rural infrastructure costs, management and administrative costs, monitoring and evaluation costs).

The comparison of these positive (benefits) and negative (costs) economic flows results in the project's *aggregated net incremental benefit* cash flow. Using this cash flow, and applying an appropriate SDR, the analyst can calculate the economic indicators (ENPV, EIRR and BCR), against which investment decisions should be made to assess the viability and profitability of the project.

Economic prices and economic farm budget in the Guideland project

In the Guideland project, economic prices are estimated taking into account the following information:

- **Non-tradable goods** are valued at their market prices (equivalent to those used in the financial analysis), net of indirect taxes (VAT = 10 per cent), since no major market distortions have been identified, and the analysis uses local currency and local relative price systems.
- The **labour market wage** is considered too high since structural unemployment reaches 30 per cent of the total available active economic population in the project area. Therefore, the SWR has been estimated at 70 per cent of market price, equivalent to $1.4 per person-day.
- For **tradable goods**, the market prices (net of VAT) must be corrected by adequate shadow prices since the country is imposing heavy export taxes (15 per cent) and import duties (25 per cent).

The national planning authorities have determined that the SER is equivalent to US$1 = $1.38 and the OER is US$1 = $1.15. Therefore, the foreign exchange premium (SER/OER) = 1.2 is applied in converting the international prices of traded goods and services into the domestic numeraire. Alternatively, the inverse of the SERF (the SCF) equal to OER/SER = 1/SERF = 0.83 could be applied in converting non-traded goods to the foreign numeraire.

To convert market prices into economic prices we need to identify all of the project's tradable goods. In general, all production outputs and all purchased inputs, including equipment, are tradable goods. Land, labour and planting material are non-tradable.

As a general rule, economic prices can also be calculated starting from the financial market prices, using the following equation:[64]

$$Economic\ price = Financial\ price - Duty + Premium$$

As was shown in table 5, the economic prices can also be calculated by computing parity prices. Table 29 shows the differences in estimating the economic price of an importable input for different numeraires, using the above assumptions for exchange rate and import duties. Conversion factors differ, depending on which numeraire is used in the analysis.

64 This equation has been simplified. The complete formula would require summing up or subtracting transportation cost to project location. Whether to include or exclude such cost depends on the nature of the good (input or output) and classification (imported; importable; exported). More details on the whole procedure are provided in the appendix.

TABLE 29

IPP of an importable input in two different numeraires

	Currency	Financial	Economic	
		Value	Domestic numeraire	Foreign numeraire
Import price at port before entry	US$	20		
Exchange rate	LCU:US$	20×1.15 = 23	20×1.38 = 27.6	20×1.15 = 23
Import price at port after entry (TR)[a]	LCU	23	27.6	23
Import duty (TS)[a]	LCU	23×25% = 5.7	excluded	excluded
VAT (TS)[a]	LCU	28.7×10% = 2.8	excluded	excluded
Transport to project location (NTR)[a]	LCU	20	20×1 = 20	20×0.83 = 16.6
Import parity price at farmgate	LCU	23+5.7+2.8+20 = 51.5		
Economic price at farmgate			**47.6**	**39.6**
Conversion factors			**47.6/51.5 = 0.92**	**39.6/51.5 = 0.77**

[a] TR = tradable; TS = transfer payment; NTR = non-tradable.

Economic prices are applied in the coffee farm, and the budget is shown in table 30 (WOP and WP situations) and table 31 (incremental).

TABLE 30
Coffee farm economic budget (in $)

Coffee farm – Economic budget (in $ per farm)	Without project	With project				With project								
	1 to 20	1	2	3	4	5	6	7	8	9	10	11	12	13 to 20
PRODUCTION														
Maize	237.5	251.5	531.0	558.9	558.9	558.9	558.9	558.9	558.9	558.9	558.9	558.9	558.9	558.9
Cassava	434.7	434.7	465.8	496.8	527.9	558.9	558.9	558.9	558.9	558.9	558.9	558.9	558.9	558.9
Banana (existing + new)	2,235.6	1,490.4	1,552.5	1,676.7	2,608.2	2,794.5	2,918.7	2,980.8	2,980.8	2,980.8	2,980.8	2,980.8	2,980.8	2,980.8
Coffee	–	–	–	–	1,056.3	2,230.0	3,521.1	4,929.5	5,399.0	5,868.5	6,220.6	6,455.3	6,572.7	6,572.7
Total production	**2,907.8**	**2,176.6**	**2,549.2**	**2,732.4**	**4,751.3**	**6,142.3**	**7,557.6**	**9,028.1**	**9,497.6**	**9,967.1**	**10,319.2**	**10,553.9**	**10,671.3**	**10,671.3**
PRODUTION COSTS														
Investment														
Purchased inputs fertilizer	–	37.9	73.5	109.1	106.9	71.3	35.6	–	–	–	–	–	–	–
chemicals	–	2.0	2.0	2.0	–	–	–	–	–	–	–	–	–	–
banana suckers	–	9.5	9.5	9.5	–	–	–	–	–	–	–	–	–	–
coffee seedlings	–	315.0	351.0	387.0	387.0	72.0	36.0	–	–	–	–	–	–	–
land preparation	–	81.0	81.0	81.0	81.0	–	–	–	–	–	–	–	–	–
farm equipmemt	–	3,780.0	1,620.0	642.6	–	–	–	–	–	–	–	–	–	–
Subtotal purchased inputs	–	*4,225.3*	*2,137.0*	*1,231.2*	*574.9*	*143.3*	*71.6*	–	–	–	–	–	–	–
Hired labour Investment unskilled labour	–	72.8	95.2	106.4	99.4	33.6	11.2	–	–	–	–	–	–	–
Subtotal investment costs	–	**4,298.1**	**2,232.2**	**1,337.6**	**674.3**	**176.9**	**82.8**	–	–	–	–	–	–	–
Operating														
Purchased Inputs maize seeds	5.9	5.9	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
cassava cuttings	3.4	3.4	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
fertilizer	–	15.6	40.1	62.4	84.6	93.6	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0
chemicals	–	4.1	10.1	14.2	38.5	58.7	79.0	99.2	99.2	99.2	99.2	99.2	99.2	99.2
sack	1.3	1.6	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
banana suckers	2.8	1.9	3.0	4.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Subtotal purchased inputs	*13.4*	*32.5*	*72.5*	*99.9*	*148.5*	*177.7*	*202.4*	*222.6*	*222.6*	*222.6*	*222.6*	*222.6*	*222.6*	*222.6*
Hired labour Operating unskilled labour	184.1	207.9	305.2	373.8	532.0	589.4	646.8	701.4	701.4	701.4	701.4	701.4	701.4	701.4
Subtotal operating costs	**197.5**	**240.4**	**377.7**	**473.7**	**680.5**	**767.1**	**849.2**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**
Total production cost	**197.5**	**4,538.5**	**2,609.9**	**1,811.3**	**1,354.8**	**943.9**	**932.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**
Net benefit before financing	**2,710.3**	**-2,361.9**	**-60.7**	**921.1**	**3,396.5**	**5,198.4**	**6,625.6**	**8,104.1**	**8,573.6**	**9,043.0**	**9,395.2**	**9,629.9**	**9,747.3**	**9,747.3**

TABLE 31

Coffee farm economic budget (incremental)

Farm model – Net incremental benefit (in $)		Without project	With project												
		1 to 20	1	2	3	4	5	6	7	8	9	10	11	12	13 to 20
INCREMENTAL PRODUCTION															
Total production	$	2,907.8	2,176.6	2,549.2	2,732.4	4,751.3	6,142.3	7,557.6	9,028.1	9,497.6	9,967.1	10,319.2	10,553.9	10,671.3	10,671.3
Incremental production	**$**	**–**	**-731.2**	**-358.6**	**-175.4**	**1,843.4**	**3,234.5**	**4,649.7**	**6,120.3**	**6,589.7**	**7,059.2**	**7,411.3**	**7,646.1**	**7,763.4**	**7,763.4**
INCREMENTAL COST															
Investment cost	$	–	4,298.1	2,232.2	1,337.6	674.3	176.9	82.8	–	–	–	–	–	–	–
Operating cost	$	197.5	240.4	377.7	473.7	680.5	767.1	849.2	924.0	924.0	924.0	924.0	924.0	924.0	924.0
Total production cost	**$**	**197.5**	**4,538.5**	**2,609.9**	**1,811.3**	**1,354.8**	**943.9**	**932.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**	**924.0**
Incremental cost	**$**	**–**	**4,341.0**	**2,412.3**	**1,613.8**	**1,157.3**	**746.4**	**734.5**	**726.5**	**726.5**	**726.5**	**726.5**	**726.5**	**726.5**	**726.5**
Net incremental benefit	**$**	**–**	**-5,072.2**	**-2,771.0**	**-1,789.2**	**686.2**	**2,488.1**	**3,915.3**	**5,393.8**	**5,863.3**	**6,332.8**	**6,684.9**	**6,919.6**	**7,037.0**	**7,037.0**
	EIRR =	**28.8%**													
	ENPV =	**$32,681**													

Now that we have fully performed our calculation for the farm model, we can compare the results obtained in the financial analysis (presented in table 22) with those from the economic analysis of the coffee farm model:

(a) FNPV = $21,803 @7% and FIRR = 23.6%

(b) ENPV = $32,681 @5% and EIRR = 28.8%

The economic profitability indicators are "higher" than those for the financial profitability. What does this mean? First, they prove that the investment proposal is more attractive from the "economy as a whole" perspective than from a "private" perspective. Second, the analysis of the detailed flows of costs and benefits shows that the real economic value of the resources used in the projects (i.e., investments and inputs) is lower than the market value, and that the economic value of the outputs is higher than their market value. Third, the analysis also shows that the main distortions are found in the trade barriers for the import of project inputs and the export taxes that affect the domestic prices obtained by the producers. Finally, the correction of distortions in the foreign exchange rate plays an important role in explaining the differences between the financial and economic performance indicators.

Single results (farm economic budgets) should be properly aggregated to obtain the aggregated net incremental economic benefits of the project.

Aggregation of the net incremental economic benefits of the project

Now it is time to estimate the net incremental economic benefits of the project "as a whole". This task is based on the results obtained in the economic farm budgets and the number of beneficiaries for each farm model. Therefore, the farm economic budgets of the different types of beneficiaries should be clearly presented. In addition, a clear "matrix of incorporation" of the different types (i.e., farm models) and number of beneficiaries is needed. The matrix of incorporation (also called schedule of participating beneficiaries, phasing of beneficiaries, etc.) is a table with columns showing the years of the project implementation and rows showing the number of participants in the project, per each type (farm model).

As an example, table 32 shows the cumulative matrix of incorporation of the Egypt "On Farm Irrigation Development Project in the Oldlands", financed by IFAD some years ago, for which the total number of beneficiary households was 5,145.

TABLE 32

Number of farms participating (cumulative) – Egypt project

	Y1	Y2	Y3	Y4	Y5 to Y20
Vegetables for processing	107	259	459	739	1,109
Spring onions for export	107	259	459	739	1,109
Herbs for export	84	211	380	608	873
Grapes for export	137	303	503	723	1,054
Citrus for high-end markets	97	212	400	650	1,000
Total per year	**532**	**1,244**	**2,201**	**3,459**	**5,145**

However, aggregating farm models is not easy. The analyst needs to respect the sequence of incorporation of the models as well as the series of annual data included in the farm budget.[65] The use of spreadsheet software (i.e., Excel) facilitates data processing, but a careful design of the tables and even more careful data processing are required to avoid erroneous calculations.

65 This type of calculation is a "matrix multiplication".

Table 33 compares the correct approach with typical inaccuracies and shows the consequences of making these mistakes. For instance, failing to use a proper aggregation technique would produce erroneous estimations of net incremental economic benefit cash flows. A common mistake is to use the cumulative matrix of incorporation instead of the matrix that indicates, year by year, the number of new participants in the project.[66]

- The blue box presents the stream of net incremental benefits (NIB) for the first five years of a hypothetical farm model.
- The orange box presents the gradual inclusion of the expected 290 beneficiaries of the model along the four years of project implementation.
- The green boxes present different approaches to performing the project's overall aggregation of NB cash flows: in green box (A), the technique is to multiply the NIB stream by the total number of beneficiaries, disregarding their gradual phasing; and in green box (B), an accumulated figure of beneficiaries by year is used and multiplied by the NIB stream. Both of these cases hugely overestimate total project aggregated benefits and NPV. This is clearly shown by looking at figures for Y4 results in the three approaches. Only the approach in green box (C) correctly considers the gradual incorporation of beneficiaries into project activities and phases the NIB cash flows accordingly, avoiding overestimations.

TABLE 33

Incorrect and correct aggregation procedure

	Y1	Y2	Y3	Y4	Y5
	a	b	c	d	e
Expected net benefit	-560	200	250	500	750

	Y1	Y2	Y3	Y4	Total
	f	g	h	i	j
Number of beneficiaries	50	80	100	60	**290**
	k	l	m	n	o
Cumulative no. of beneficiaries	50	130	230	290	**580**

(A) Aggregation neglecting the timing	Y1	Y2	Y3	Y4	Y5	NPV @10%
Formulas	a×j	b×j	c×j	d×j	e×j	
	-162,400	58,000	72,500	145,000	217,500	**€188,855**

(B) Aggregation neglecting the timing and the phasing	Y1	Y2	Y3	Y4	Y5	NPV @10%
Formulas	a×k	b×l	c×m	d×n	e×o	
	-28,000	26,000	57,500	145,000	435,000	**€408,371**

(C) Aggregation considering the appropriate timing and phasing	Y1	Y2	Y3	Y4	Y5	NPV @10%
Formulas	a×f	b×f	c×f	d×f	e×f	
	-28,000	10,000	12,500	25,000	37,500	
Formulas		a×g	b×g	c×g	d×g	
		-44,800	16,000	20,000	40,000	
Formulas			a×h	b×h	c×h	
			-56,000	20,000	25,000	
Formulas				a×i	b×i	
				-33,600	12,000	
Total	-28,000	-34, 800	-27,500	**31,400**	**114,500**	**€17,666**

66 The cumulative matrix of incorporation should be used only for presentation purposes.

This aggregation procedure becomes even more complicated when a project includes several farm models. This is one of the great advantages of using FARMOD – a programme that was designed for the EFA of agricultural development projects.[67] One of its features is the way in which the aggregation problem is solved.

In the Guideland project example, the matrix of incorporation is rather simple, since there is only one type of beneficiary (the coffee farm model). The total number of beneficiaries is 2,000, and households will be added to the project according to the phasing presented in table 34.

TABLE 34
Matrix of incorporation of beneficiaries

Farm models	Without project	With project		
	1 to 20	PY 1	PY 2	PY 3
Coffee farm model	2,000	500	1,000	500

With the information included in the farm economic budgets (table 30) and the data from the matrix of incorporation (table 34), it is now possible to undertake the aggregation of the data for the project as a whole. Table 35 shows the aggregated flow of net incremental economic benefits for the 2,000 beneficiaries of the coffee farm model of the Guideland project.

67 Gordon Temple, et al., formulated FARMOD in the early 1980s. Now available in a renewed version developed by IFAD.

TABLE 35

Aggregation of net incremental economic benefits of the Guideland project

Project – Economic budget (in $ per year)	Without project	With project						With project								
	1 to 20	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15 to 20
PRODUCTION																
Maize	475,065	482,051	635,749	936,158	1,103,828	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800
Cassava	869,400	869,400	884,925	931,500	993,600	1,055,700	1,102,275	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800	1,117,800
Banana (existing + new)	4,471,200	4,098,600	3,384,450	3,136,050	3,757,050	4,843,800	5,557,950	5,806,350	5,930,550	5,961,600	5,961,600	5,961,600	5,961,600	5,961,600	5,961,600	5,961,600
Coffee	–	–	–	–	528,161	2,171,327	4,518,707	7,100,825	9,389,520	10,797,948	11,678,216	12,382,430	12,851,906	13,086,644	13,145,328	13,145,328
Total production	**5,815,665**	**5,450,051**	**4,905,124**	**5,003,708**	**6,382,638**	**9,188,627**	**12,296,732**	**15,142,775**	**17,555,670**	**18,995,148**	**19,875,416**	**20,579,630**	**21,049,106**	**21,283,844**	**21,342,528**	**21,342,528**
PRODUTION COSTS								**11,190,000**								
Investment							**12,085,200**	**12,085,200**								
Purchased inputs fertilizer	–	18,934	74,621	147,015	199,361	197,134	142,560	71,280	17,820	–	–	–	–	–	–	–
chemicals	–	1,013	3,038	4,050	3,038	1,013	–	–	–	–	–	–	–	–	–	–
banana suckers	–	4,725	14,175	18,900	14,175	4,725	–	–	–	–	–	–	–	–	–	–
coffee seedlings	–	157,500	490,500	702,000	756,000	616,500	283,500	72,000	18,000	–	–	–	–	–	–	–
land preparation	–	40,500	121,500	162,000	162,000	121,500	40,500	–	–	–	–	–	–	–	–	–
farm equipmemt	–	1,890,000	4,590,000	3,831,300	1,452,600	321,300	–	–	–	–	–	–	–	–	–	–
Subtotal purchased inputs	–	*2,112,671*	*5,293,834*	*4,865,265*	*2,587,174*	*1,262,171*	*466,560*	*143,280*	*35,820*	–	–	–	–	–	–	–
Hired labour Investment unskilled labour	–	36,400	120,400	184,800	203,700	169,400	88,900	28,000	5,600	–	–	–	–	–	–	–
Subtotal investment costs	**–**	**2,149,071**	**5,414,234**	**5,050,065**	**2,790,874**	**1,431,571**	**555,460**	**171,280**	**41,420**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Operating																
Purchased inputs maize seeds	11,781	11,781	14,726	20,617	23,562	23,562	23,562	23,562	23,562	23,562	23,562	23,562	23,562	23,562	23,562	23,562
cassava cuttings	6,840	6,840	7,268	8,123	8,550	8,550	8,550	8,550	8,550	8,550	8,550	8,550	8,550	8,550	8,550	8,550
fertilizer	–	7,796	35,640	79,076	124,740	162,608	184,883	193,793	196,020	196,020	196,020	196,020	196,020	196,020	196,020	196,020
chemicals	–	2,025	9,113	19,238	38,475	74,925	117,450	157,950	188,325	198,450	198,450	198,450	198,450	198,450	198,450	198,450
sack	2,592	2,754	3,888	5,670	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
banana suckers	5,670	2,835	810	1,350	2,700	3,713	4,050	4,050	4,050	4,050	4,050	4,050	4,050	4,050	4,050	4,050
Subtotal purchased inputs	*26,883*	*34,031*	*71,444*	*134,073*	*204,507*	*279,837*	*344,975*	*394,385*	*426,987*	*437,112*	*437,112*	*437,112*	*437,112*	*437,112*	*437,112*	*437,112*
Hired labour Operating unskilled labour	368,200	380,800	401,100	526,050	774,900	1,013,600	1,178,800	1,292,200	1,375,500	1,402,800	1,402,800	1,402,800	1,402,800	1,402,800	1,402,800	1,402,800
Subtotal operating costs	**395,083**	**414,831**	**472,544**	**660,123**	**979,407**	**1,293,437**	**1,523,775**	**1,686,585**	**1,802,487**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**
Total production cost	**395,083**	**2,563,903**	**5,886,778**	**5,710,188**	**3,770,281**	**2,725,008**	**2,079,235**	**1,857,865**	**1,843,907**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**	**1,839,912**
Outflows	395,083	2,563,903	5,886,778	5,710,188	3,770,281	2,725,008	2,079,235	1,857,865	1,843,907	1,839,912	1,839,912	1,839,912	1,839,912	1,839,912	1,839,912	1,839,912
Cash flow before financing	**5,420,582**	**2,886,149**	**-981,654**	**-706,481**	**2,612,357**	**6,463,618**	**10,217,497**	**13,284,910**	**15,711,763**	**17,155,236**	**18,035,504**	**18,739,718**	**19,209,194**	**19,443,932**	**19,502,616**	**19,502,616**

Project costs in financial terms should be converted into project economic costs by applying adequate conversion factors.

Estimating the economic costs of the project

Total project costs in financial terms (i.e., at market prices) are determined according to the different project objectives and components. Usually, the tool used is COSTAB, which lists project costs according to different breakdown criteria (by project components and subcomponents, by expenditure accounts, etc.) for the life of the project. The project life (also called project implementation period) is usually considered as the period during which all investments and incremental costs occur, and it

coincides with the period of disbursement of the external loans. In IFAD-financed projects, the typical project life varies from four to six years.[68]

The determination of project costs should always be linked with the project objectives and expected impacts (see IFAD costing guidelines for more details). This leads to the preparation of project cost tables by component. For example, in a typical "productive project", the main objective of increasing production would imply identifying the incremental costs at the farm level, incremental costs for providing extension services, incremental costs for providing

68 In the Guideland project, the implementation period is seven years.

TABLE 36

Project costs by expenditure categories and by year (at market prices)

Financial project costs ($ '000) – Expenditure categories	Years			Years				Total
	PY 1	PY 2	PY 3	PY 4	PY 5	PY 6	PY 7	
1. Vehicles	100	123	–	–	–	–	–	**223**
2. Fuel and other inputs	60	86	120	80	40	40	30	**456**
3. Office equipment	25	25	–	–	–	–	–	**50**
4. Grant for on-farm investment	2,052	5,214	4,979	2,922	1,609	663	208	**17,647**
5. Salaries	414	693	897	1,399	1,138	654	197	**5,391**
– Extensionists	*255*	*529*	*730*	*1,226*	*961*	*474*	*72*	***4,247***
– Professionals	*151*	*151*	*151*	*151*	*151*	*151*	*121*	***1,027***
– Clerks	*4*	*9*	*12*	*18*	*22*	*25*	–	***89***
– Non-qualified personnel	*4*	*4*	*4*	*4*	*4*	*4*	*4*	***28***
Total base-costs	**2,651**	**6,140**	**5,996**	**4,401**	**2,787**	**1,357**	**435**	**23,767**

financial services, incremental costs for other production support services (e.g., animal health, irrigation management), and incremental costs for the project management and monitoring. In brief, in addition to the incremental on-farm costs for the pertinent period of the project life, the "other costs" that need to be considered are the off-farm costs of the components that help the beneficiaries implement the proposed innovations.

Nevertheless, in the traditional approach to the preparation of project cost tables in financial terms, only monetary flows are taken into consideration. As a consequence, the usual project cost table does not include all on-farm incremental costs, particularly on-farm incremental family labour[69] and farmers' in-kind contributions. These omissions lead to underestimating the beneficiaries' contributions in the "real" project costs and the corresponding project financing plan.[70] However, it is usual to include in the project cost tables the incremental on-farm costs for investments or inputs financed by (a) the farmers (for example, with family savings); (b) a "financing services" facility component (grants, long-term loans, short-term credit, etc.); or (c) a combination of both financial sources.

For the financial and economic evaluation, the table by expenditure category and by year (COSTAB table EAYRB) must be used to avoid double-counting costs, as each expenditure category has its own financing rule. For the Guideland project, project expenditures by year are presented in table 36.

The next step is to differentiate traded and non-traded goods and services in the cost tables. COSTAB produces a breakdown cost table by "expenditures" that is a very useful tool for this purpose.

In table 37, Categories 1 to 3 are classified as traded goods and services, and their prices were converted to economic prices (CF = 0.81). The funds for grants and credits will be used for on-farm investments. Category 4 (salaries) is classified as non-traded services. Since salaries are not charged with indirect taxes (i.e., VAT),[71] all non-traded goods will be valuated at their local market prices.

69 If the WP situation implies that the beneficiaries should work more man-days than in the WOP situation (within the project life period), these incremental man-days should be considered as part of the project costs and also as beneficiaries' contributions to total project costs. Since they do not imply monetary flows, they are excluded from the typical project cost tables.

70 These IGs suggest that, to appropriately reflect the effective contribution of the beneficiaries to total project costs, an estimate of the farmers' contributions through their "incremental family labour" be presented as complementary data to the project cost tables and financing plan.

71 Other types of labour remunerations (e.g., professional technical assistance services) usually pay VAT.

TABLE 37

Identification of traded and non-traded goods and services in the project

Expenditure categories	Traded	Non-traded
1. Vehicles	✓	
2. Fuel and other inputs	✓	
3. Office equipment	✓	
4. Salaries		
– Extensionists		✓
– Professionals		✓
– Clerks		✓
– Non-qualified personnel		✓

All traded goods and services, net of VAT,[72] will be valuated at their border prices (import duties are 25 per cent). For all items converted in border prices (expressed in $), the **SERF = SER/OER = 1.2** has to be applied to reflect the real social cost of foreign exchange.[73] The result of these calculations is the table of economic values for the project cost expenditure categories by year (table 38).

72 COSTAB software produces economic prices automatically by discounting the VAT from the total project base-costs.

73 The following operations are performed when working in local currency and the local relative price system (scenario 1, Box 13): (a) every item expressed in local currency (i.e., market price minus VAT) is transformed into its border price by deducting import duties; and (b) once we have the border price expressed in local currency, it should be corrected by the SCF = 1.2 to obtain the final economic price. If we had the border prices expressed in foreign currency (a typical example is an imported good that is not quoted in the local market), the operations to get the economic price in local currency are as follows: (a) convert the BP in US$ into the border price in local currency by multiplying it by the SER, and (b) subtract the VAT.

TABLE 38

Project economic costs

Financial project costs ($ '000) – Expenditure categories	Years			Years				Total
	PY 1	PY 2	PY 3	PY 4	PY 5	PY 6	PY 7	
1. Vehicles	81	100	–	–	–	–	–	**181**
2. Fuel and other inputs	49	70	97	65	32	32	24	**369**
3. Office equipment	20	20	–	–	–	–	–	**41**
4. Grant for on-farm investment	2,149	5,414	5,050	2,791	1,432	555	213	**17,604**
5. Salaries	414	693	897	1,399	1,138	654	197	**5,391**
– Extensionists	*255*	*529*	*730*	*1,226*	*961*	*474*	*72*	***4,247***
– Professionals	*151*	*151*	*151*	*151*	*151*	*151*	*121*	***1,027***
– Clerks	*4*	*9*	*12*	*18*	*22*	*25*	*–*	***89***
– Non-qualified personnel	*4*	*4*	*4*	*4*	*4*	*4*	*4*	***28***
Total base-costs	**2,713**	**6,296**	**6,044**	**4,255**	**2,602**	**1,242**	**434**	**23,586**

TABLE 39

Project economic analysis

Cash flow – Economic prices ($ '000)	Without project	Years with project						Years with project								
		PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12	PY13	PY14	PY15-20
INCREMENTAL BENEFITS																
Rural production benefits	5,816	5,450	4,905	5,004	6,383	9,189	12,297	15,143	17,556	18,995	19,875	20,580	21,049	21,284	21,343	21,343
Incremental benefits	**–**	**-366**	**-911**	**-812**	**567**	**3,373**	**6,481**	**9,327**	**11,740**	**13,179**	**14,060**	**14,764**	**15,233**	**15,468**	**15,527**	**15,527**
INCREMENTAL COSTS																
Rural production costs																
Investment inputs	–	2,113	5,294	4,865	2,587	1,262	467	143	36	–	–	–	–	–	–	–
labour	–	36	120	185	204	169	89	28	6	–	–	–	–	–	–	–
Operation inputs	27	34	71	134	205	280	345	394	427	437	437	437	437	437	437	437
labour	368	381	401	526	775	1,014	1,179	1,292	1,376	1,403	1,403	1,403	1,403	1,403	1,403	1,403
Subtotal rural production costs	**395**	**2,564**	**5,887**	**5,710**	**3,770**	**2,725**	**2,079**	**1,858**	**1,844**	**1,840**	**1,840**	**1,840**	**1,840**	**1,840**	**1,840**	**1,840**
Project cost																
Base cost[a] Vehicles	–	81	100	–	–	–	–	–	–	–	–	–	–	–	–	–
Fuel and other inputs	–	49	70	97	65	32	32	24	–	–	–	–	–	–	–	–
Office equipment	–	20	20	–	–	–	–	–	–	–	–	–	–	–	–	–
Salaries	–	414	693	897	1,399	1,138	654	197	–	–	–	–	–	–	–	–
Subtotal project cost	**–**	**564**	**882**	**994**	**1,464**	**1,170**	**686**	**221**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Incremental costs	**–**	**2,733**	**6,374**	**6,309**	**4,839**	**3,500**	**2,370**	**1,684**	**1,449**	**1,445**	**1,445**	**1,445**	**1,445**	**1,445**	**1,445**	**1,445**
Net incremental benefit	**–**	**-3,098**	**-7,284**	**-7,121**	**-4,272**	**-127**	**4,111**	**7,643**	**10,291**	**11,735**	**12,615**	**13,319**	**13,789**	**14,023**	**14,082**	**14,082**

EIRR =	25.1%	
ENPV =	77,565	$'000
B/C ratio =	3.34	

[a] Without the costs included in Rural production costs, Investment.

At this point, the analyst has all project net incremental economic benefits and all project economic costs. However, this analysis does not include all project impacts on society as a whole.

c. Externalities

As has been mentioned, externalities[74] are real costs and benefits for the economy that are attributable to the project, and they should be included in the economic analysis as project costs (negative externalities) or as project benefits (positive externalities).

Clear and sufficient information should be provided about the identification and valuation of positive and negative externalities and their inclusion in the corresponding flows of benefits and costs of the project.

To simplify the presentation of this example, it has been assumed that the Guideland project does not have positive or negative externalities.

Calculate the project economic profitability indicators.

d. The economic analysis of the Guideland Rural Development Project

With all these elements, it is now possible to complete the economic analysis of the project. The analysis is performed for a 20-year period, and the SDR (provided by the National Planning Office) is 5 per cent.

The calculation of the project economic profitability indicators requires the following methodological guidelines:

(a) The unit now under analysis is the project as a whole, and therefore we need to compare the aggregated net incremental economic benefits with total project economic costs (table 38).
(b) To avoid double-counting project costs in the economic analysis of the project, we should consider only those costs that are off-farm costs (investment and/or operating costs), which have already been taken into consideration when calculating the flow of net incremental economic benefits.[75]

After the correction of price/wage distortions and the choice of an appropriate SDR, it is possible to calculate the Guideland project's economic performance (table 39).

The economic indicators are as follows.

(a) Economic net present value – ENPV @5% = $77,564,743
(b) Economic internal rate of return – EIRR = 25.1%

They prove the economic feasibility (i.e., the convenience for society as a whole) of the proposed Guideland Rural Investment Project.

Table 2 on page 18 provides a summary of all necessary steps to conduct the economic analysis.

In principle, every project with an EIRR lower than the SDR or a negative ENPV should be rejected: a project with a negative ENPV uses too much of socially valuable resources to achieve too modest benefits for all citizens. In some exceptional cases, however, a project with a negative ENPV could be accepted for IFAD assistance if there are important non-monetized benefits (e.g., to preserve biodiversity or cultural heritage sites, or to achieve malnutrition or food security objectives). This should be seen as a rare occurrence, and the appraisal report should still specify in a convincing way, through a structured argument that is sustained by adequate data, that social benefits exceed social costs, even if the analyst is unable to fully quantify the former.

Carry out sensitivity analysis, taking into account reasonable variations in the expected costs and benefits. This analysis provides the basis for a proper risk assessment of the project and for the inclusion of efficient mitigation measures in project design.

74 An externality can be either positive or negative and is the consequence of an economic activity that is experienced by unrelated third parties.

75 Experience demonstrates that this is a typical mistake in numerous project economic analyses.

The sensitivity analysis of the Guideland project is shown in table 40.

TABLE 40
Sensitivity analysis of Guideland project

Indicator	EIRR	ENPV US$ millons	BCR
Benefits reduction			
10%	23.2%	66.49	3.00
20%	21.1%	55.42	2.67
30%	18.8%	44.34	2.34
Costs increasing			
10%	23.6%	75.23	3.12
20%	22.3%	72.90	2.93
Benefits reduction 20% + Costs increasing 20%	18.5%	50.76	2.34
Benefits delay			
1 year	21.4%	66.72	3.00
2 years	18.4%	56.39	2.70
3 years	15.9%	46.55	2.40
Switching values			
Benefits reduction		-70%	
Costs increasing		234%	

The table shows that the project produces very robust results: its main economic profitability indicators do not change significantly as a result of changes in the expected benefits or costs. The most sensitive variable seems to be the delays in the perception of gross benefits, but the EIRR remains high (15.9 per cent) when compared with the SDR of 5 per cent.

It is important to specify that the cost increase refers exclusively to investment and operation inputs, because the family labour cost will not change: the farm is the family business, and the availability of off-farm employment is very limited. Moreover, the costs of the project hardly change, since external financing is clearly established in the loan agreement.

The review of these results confirms the robustness of the project. The probability of a 70 per cent decrease in expected benefits – resulting in a negative ENPV – is very low. The necessary increases in the different cost items to reach critical values are so high that their likelihood is practically nil.

Recent software developments have made available more sophisticated tools for a probabilistic risk analysis (e.g., Monte Carlo simulation).[76]

76 Practical examples of the use of this technique are provided in IFAD's EFA Guidelines Volume 3, pages 124-134.

ANNEX I

Detailed discussion on the calculation of economic prices

The non-trivial selection of the numeraire

The analyst may find him or herself working in one of the four scenarios presented in table A1, depending on the currency (local or foreign) in which he/she is working and the relative price system adopted. Scenarios 1 and 2 are the most commonly used in economic analysis. These IGs recommend adopting the domestic price level numeraire expressed in local currency (scenario 1) when possible, since the financial analysis is normally carried out using local prices at the domestic market price level.

TABLE A1

Possible combinations in the selection of the numeraire

Scenario	Currency	Price level
1	Local (LCU)	Domestic
2	Foreign (US$)	International
3	Local (LCU)	International
4	Foreign (US$)	Domestic

Source: Adapted from ADB (1997).

To calculate the project economic profitability for the whole society, we need to value all goods and services – tradable and non-tradable – using the same currency and price level. Therefore, we need to convert international prices into local prices, or the other way around, using appropriate calculations and conversion factors. The two parts of table A2 provide a summary of the formulas to use in calculating economic prices for tradable and non-tradable goods and services, depending on the numeraire being used.

TABLE A2

Formulas to calculate the economic prices of tradable and non-tradable items

Tradable	Price level	
	Domestic	International
Local currency	BP(US$)×SER	BP(US$)×OER
Foreign currency	BP(US$)×SERF	BP(US$)

Non-tradable	Price level	
	Domestic	International
Local currency	MP	MP×CF (or SCF)
Foreign currency	MP/OER	(MP×CF)/OER

Note: BP = border price in US$; MP = market price in LCU (net of taxes); OER = official exchange rate (LCU:US$); SER = shadow exchange rate; SERF = shadow exchange rate factor; SCF = standard conversion factor.

To make this concept more intuitive, we present a numerical example for various scenarios. Let's assume we want to calculate the economic price for a good and country statistics show the following data on trade restriction and foreign exchange:

TABLE A3

Project assumptions on CFs and trade

Official exchange rate (OER)	LCU/US$	20
Shadow exchange rate (SER)	LCU/US$	24
SERF (SER/OER)	ratio	1.2
Standard conversion factor (SCF)	ratio	0.83
Import tariff	% of CIF	10%
Fertilizer (tradable)	US$/ton	140
Haircut (non-tradable)	LCU	20

Under scenario 1, the opportunity cost for any tradable good can be calculated by starting with its border price (BP): f.o.b. for exports and c.i.f. price for imports.[77] In our scenario, we are working with a numeraire in local currency and a domestic price level. If we need to find out the economic price of an imported good such as a fertilizer with a BP of US$140 in a market with no trade barriers, then SER = OER and the true economic value of the commodity would be equal to US$140 or LCU 2,800.

Because there is a trade import duty, the SER > OER, and the true economic price of fertilizer at the entry port[78] for the local economy would be:

$$EP^{*}_{fertilizer} = BP(US\$) \times SER = 140 \times 24 = LCU\,3{,}360$$

Alternatively, if we did not know the international c.i.f price of our good, we could work our calculation backwards, by deducting internal transport costs and import duties from the input price sourced at market level. Assuming an internal cost of LCU 700[79] and the import tariff of 10 per cent (on the c.i.f.), we could obtain the economic price of the input at the port of entry as:

$$EP^{*}_{fertilizer} = \left(MP_{fert}(LCU) - transport - import\ duty\right) \times SERF$$

$$EP^{*}_{fertilizer} = (3{,}780 - 700 - 280) \times 1.2 = LCU\,3{,}360$$

The two calculations provide exactly the same result, irrespective of the procedure used. With this in mind, we can proceed to calculate the CF for fertilizers. But first we need to calculate the market value of the fertilizer at the point of entry after duty (MP*). This will be equal to:

$$MP^{*}_{fert} = \left(MP_{fert}(LCU) - transport\right)$$

$$MP^{*}_{fert} = (3{,}780 - 700) = 3{,}080$$

Therefore, the CF of our fertilizer at the port of entry can be calculated as:

$$CF_{fertilizer} = \frac{EP_{fert}}{MP_{fert}} = \frac{3{,}360}{3{,}080} = 1.09$$

The conversion of non-tradable items depends on whether the item can be broken down into tradable and non-tradable components. If the item can be disaggregated, the analyst should evaluate tradable items according to the procedure and formulas described in table A2.[80] If the item is considered entirely non-tradable, then its value under scenario 1 (domestic; local) would be equal to its face market value. For instance, under scenario 1, the economic price of a haircut (an entirely non-tradable service) would be equal to its local market value (LCU 30).

Now let's perform the same analysis under *scenario 2*, which requires working with prices in foreign currency and following the international price system, and thus estimating economic prices on the basis of international prices denominated in US dollars.

For tradable goods, the economic price (EP_t) would be equal to the c.i.f. (for imports) and f.o.b. (export) border price expressed in foreign currency. Hence:

$$EP_t\,(US\$) = BP_t\,(US\$)$$

Detailed information on c.i.f. and f.o.b. prices can be obtained from national and international statistics or by using market prices expressed in LCU adjusted for transport costs and taxes occurring from production/use point to the port, and then converted into US dollars with the OER:

$$EP_t\,(US\$) = \frac{MP_t\,(LCU) - taxes - transportation - duties}{OER}$$

77 This information can be obtained from multiple sources (International Trade Centre, World Bank, FAO, national statistics bureaus, and many more).

78 If the good is further transported to the farm, all transportation costs need to be added to derive the economic price of the good at the farm level.

79 The assumption is that the economic value of transport service is composed by all non-tradable items and the good is therefore converted at par with its market value (CF=1). In reality, non-tradable goods and services can be decomposed into non-tradable and tradable components, each of which can be adequately converted based on specific CFs and consistently with the numeraire adopted.

80 More detailed information is also provided in the following sections.

Non-tradable goods (always expressed in local currency) have to be converted into foreign currency and into international price levels. The most intuitive way of proceeding is to convert local market prices (MP_{nt}) into economic foreign currency by dividing them by the SER.

$$EP_{nt}(US\$) = \frac{MP_{nt}(US\$)}{SER} = \frac{MP_{nt}(US\$)}{OER \times SERF}$$

A slightly more complicated scenario – and the one that most often leads to miscalculations – is *scenario 3*, which requires working at the international price level expressed in local currency.

For tradable goods, their BPs in US dollars are converted into local currency and subject to the international price system (no correction of foreign rate needed); therefore

$$EP_t(LCU) = BP_t(US\$) \times OER$$

or

$$EP_t(LCU) = MP_t(LCU) - taxes - transportation - duties$$

For non-tradable goods, the local price needs to be adapted to the international price level; therefore, the foreign exchange rate needs to be converted into US dollars through the SER and then reconverted into local currency, which is used in the analysis. As was discussed in previous sections, the ratio between OER and SER is exactly the SCF, which can be used unless there are no other specific CFs for the item under scrutiny. Therefore, the formula used is:

$$EP_{nt}(US\$) = \frac{MP_{nt}(US\$)}{SER} \times OER$$

or

$$EP_{nt}(US\$) = MP_{nt}(LCU) \times SER$$

The numeraire presented under *scenario 4* is almost never used, as intuitively it makes little sense to work with local price levels expressed in a foreign currency. However, the appropriate formulas are presented in table A2.

In principle, the selection of the numeraire should be based on the national objectives the project aims to achieve and the analyst, through her/his work, aims to measure – although the selection is usually made by looking at the availability of information and the convenience of calculating all the required conversion parameters. However, bearing in mind that the financial analysis is quite often carried out using domestic market level prices expressed in local currency (scenario 1), it is normally easier to keep working under the same numeraire. Nonetheless, the selection of the numeraire may also be affected by the following considerations:

(a) The share of traded goods (or the foreign component) as compared to the share of non-traded items in the project.
(b) The level of distortion affecting the exchange rate – and thus traded goods – and the level of internal distortion caused by taxes, legislation, monopolies and so on.

In projects with a large amount of non-traded goods and services, it is easier to adjust distortions of traded goods with the SERF while considering the market value of domestic resources as an appropriate measure of their opportunity cost. The opposite is clearly true for economies with a high dependence on imports and foreign trade.

Estimating economic prices of tradable goods

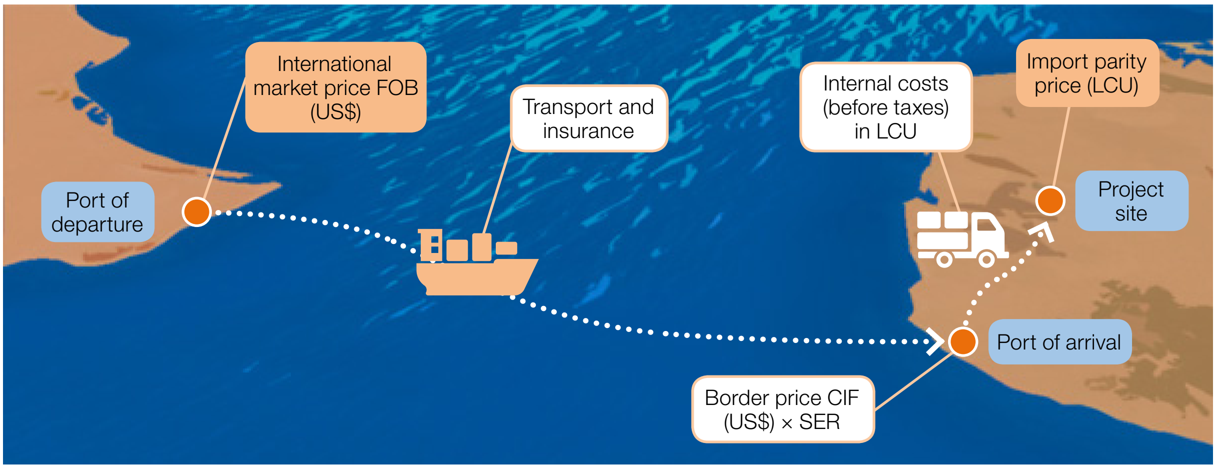
To estimate the projects' shadow prices, we need to calculate parity prices for tradable inputs and outputs. The parity price of a particular commodity is the measure of how much it would cost to buy/sell the same commodity from/to the national market – as opposed to sourcing it from the international market – once all transportation and transaction costs (exchange rate, customs duties, etc.) between the two locations are taken into consideration. Parity pricing explains why the price of a commodity (e.g., cotton) in one market is different from the price of the same commodity in another market. An analysis of the parity price of outputs clarifies whether producing the goods or services locally is more or less convenient than sourcing it from the international market. It also clarifies whether there are incentives for or obstacles to local production or international trade.

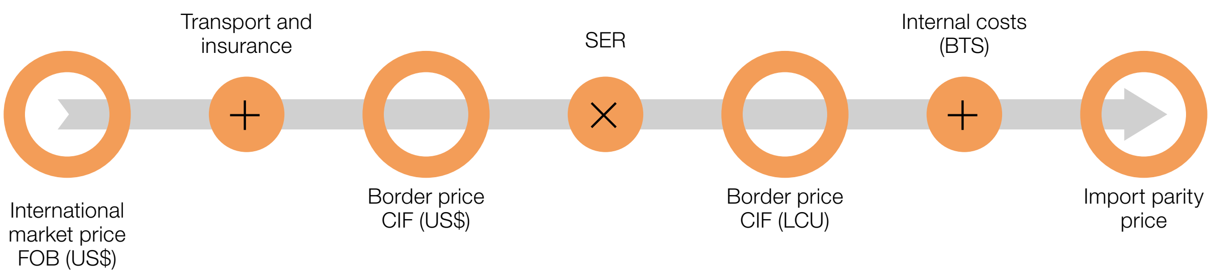
Parity prices are divided into two categories[81]: import parity prices and export parity prices.

- The *import parity price* (IPP) is the price that a purchaser would pay for imported goods; thus, it is the c.i.f. import price, converted by applying the SER, plus tariff and transport costs (before taxes and subsidies – BTS) and all internal costs (BTS) to the purchaser's location. Therefore, the IPP is the economic cost of purchasing a good on the international market and transporting it to the project location. The graphs in figure A1 present the steps involved in calculating the IPP. The calculation would start with the international f.o.b. price of the selected commodity, preferably sourced from international statistics.[82]

FIGURE A1

A synoptic view of import parity prices calculation





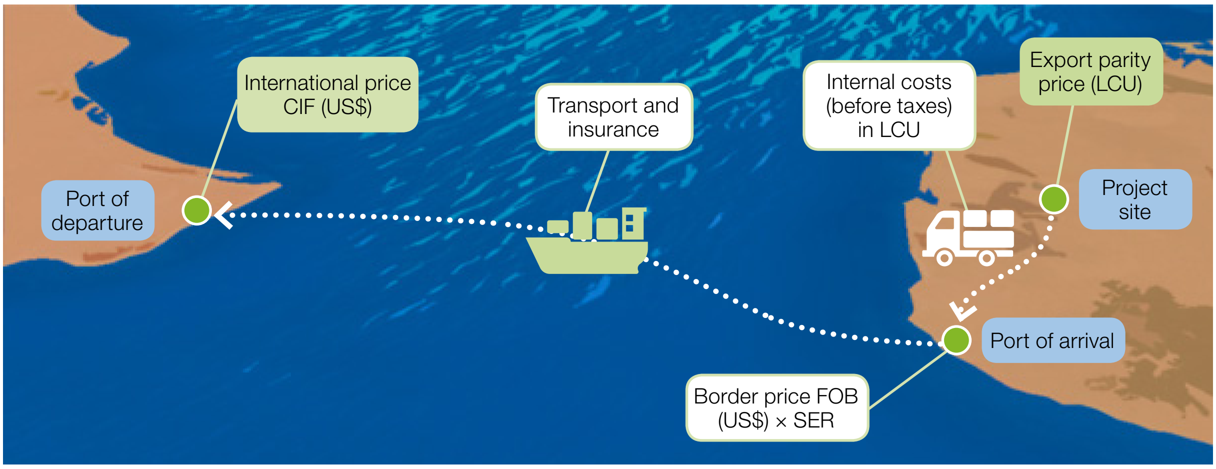
81 Prices might be further differentiated into financial parity prices and economic parity prices; the main difference between the two is the use of the SER (replacing the OER) and deduction of all transfer payments (taxes, duties and subsidies) while performing the economic calculation of the prices.

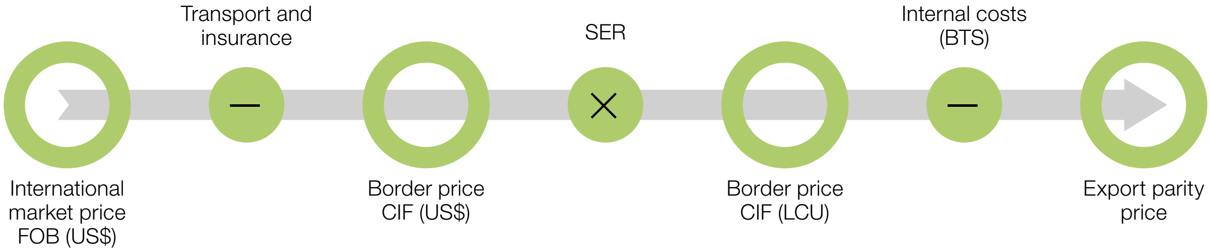
82 Analysts can easily find international prices for most agricultural commodities and agricultural inputs in FAOSTAT and World Bank or other international agencies' data repositories. When prices are not available through these sources, the analyst might calculate a proxy by dividing the total value of the item's import (or export) price by the total quantity of its import (or export). Alternatively, the analyst might use the internal market price and discount tariff rates to obtain a proxy of the c.i.f. price (or add export taxes to get a proxy of the f.o.b. price).

- Similarly, the *export parity price* (EPP) is the price that a producer would receive for its product if exported; it is equal to the f.o.b. price, once again converted into local currency with the SER, minus all the costs (BTS) incurred in getting the product from the farmgate to the border. The calculation in this case might be counterintuitive, as it is done backward with respect to the hypothetical route of the product: starting from the international price c.i.f., we will deduct the transportation and insurance to obtain the f.o.b. border price, convert that price with the SER and deduct all the internal costs (BTS), and thus we will finally obtain our EPP at project site (see figure A2).

FIGURE A2

A synoptic view of export parity price calculation





Summarizing, it is important to remember that the calculation of economic prices aims at finding the forgone opportunity value of goods and services used or produced by the project. These values are based on international market prices adjusted for transport costs, shadow exchange rate and other processing-/handling-related costs. Generally speaking, any time we need to compute the economic value for imported or importable inputs, we use their c.i.f. price, and for any exported or exportable goods we use their f.o.b. price. Border prices expressed in US dollars are then converted into domestic currency by applying the SER to get the correct economic value of the tradable good.[83]

As table A4 shows, the procedure for calculating EPPs at market level is the same whether the price is calculated for an exportable good used by the project (input) or exportable good produced by the project (output). Similarly, the procedure to obtain IPPs at market level is the same whether the IPP is calculated for an importable good produced by the project (output as an import substitution) or for an importable good used by the project as an input. Small changes in the calculation procedure are needed while calculating parity prices at the farm level (see lower part of table A4). Once the level of the analysis is set (at the farm, wholesale market or country border level), it is particularly important to derive all price information consistently to the level chosen.

TABLE A4

Detailed procedure for calculating IPPs and EPPs at market and farm level

	Input		Output	
	Importable	Exportable	Import substitute	Exportable
	Price at departure (f.o.b.)	**Price at arrival (c.i.f.)**	**Price at departure (f.o.b.)**	**Price at arrival (c.i.f.)**
Transportation	+	–	+	–
Insurance	+	–	+	–
	Border price c.i.f (US$)	**Border price f.o.b (US$)**	**Border price c.i.f (US$)**	**Border price f.o.b (US$)**
Shadow exchange rate	×	×	×	×
	Border price c.i.f (LCU)	**Border price f.o.b (LCU)**	**Border price c.i.f (LCU)**	**Border price f.o.b (LCU)**
Customs duties, tariffs and taxes	n/a	n/a	n/a	n/a
Handling and storage costs	+	–	+	–
Transportation	+	–	+	–
	IPP at market	**EPP at market**	**IPP at market**	**EPP at market**
Packaging and processing costs	+	+	–	–
Marketing costs	+	+	–	–
Transportation/processing costs	+	+	–	–
	IPP at farm	**EPP at farm**	**IPP at farm**	**EPP at farm**

83 Despite the general rule, in some cases tariff barriers are intended as corrections for price distortions in world markets. Typical example: the international prices of dairy products that are highly subsidized and exported by the European Union. Also, some internal prices might be the result of explicit national policies intended to protect infant industries (for example, national production of fertilizers) with sound basis for developing future comparative advantages. In this and in similar cases, it may be allowable to adopt the internal prices instead of the border ones, at least for part of the projected period of analysis.

Economic valuation of non-tradable goods and services

Non-tradable goods and services are those that by their nature either cannot be traded or are uneconomical to trade internationally.[84] Evaluating them can be challenging and time-consuming, especially when attempting the application of more sophisticated methodologies than those presented here. Therefore, project analysts need to decide whether the refinement is worth the additional effort.

Nonetheless, using the domestic price numeraire actually eases this process, as it allows converting tradable goods and services into economic domestic prices (parity prices) while maintaining the domestic market prices for non-tradable items. The applicability of this method relies on three assumptions: (a) domestic market prices of non-tradable goods and services are a reliable measure of their opportunity cost; (b) price changes induced by the project are negligible, or not accounted for; and (c) all non-tradable goods and services have perfect substitutes in international markets.

For tradable goods, BPs represent the opportunity cost for the country to import or export them, so they can be used as the reference value to approximate economic prices. For non-tradable goods and services, BPs as such are not available, so reference prices have to be calculated differently. The most common options to obtain reference prices for non-tradable goods and services are as follows:

(a) Taking the c.i.f. price of an import substitute, if possible.
(b) Considering the market value of the goods (net of taxes).
(c) Breaking down the price of a non-tradable item into its traded and non-traded components.
(d) Applying an average gap value to non-tradable goods and services.

Alternatively, the analyst might calculate sectorwide CFs and then apply them to the different non-traded goods categories. In exceptional cases,[85] shadow prices should be estimated on the basis of long-run marginal cost or willingness-to-pay methods.[86]

An example should help clarify the procedure for estimating the economic prices for non-traded goods in a different numeraire. Let's assume that we want to calculate the economic price for a personal care service like a haircut, starting from its market price. We could consider the local value of such a service (net of taxes), or we could break down the market price into its tradable and non-tradable components, and then proceed to evaluate each component at its opportunity cost to arrive at a final estimate of their economic value.

Let's assume that the market value of the haircut service – equal to LCU 20 – is 20 per cent for tradable items (equipment and tools), 10 per cent for a VAT, another 10 per cent for non-tradable items (site location) and finally 60 per cent for labour. The SERF in the economy is estimated at SERF = 1.2 and the shadow wage rate factor (SWRF) for labour is equal to SWRF = 0.73. The calculation procedure for the economic value of the service – at the domestic price level numeraire – is shown in table A5.

84 Labour, land, real estate, hotel accommodations, electricity (in some cases), health services, haircuts and other services are typically non-tradable, especially in the short term. Non-tradable goods also include goods whose costs of production and transportation are so high as to preclude trade, even under conditions of free trade. In principle, any good or service would fall into this category if its c.i.f. cost (landed price) is greater than the local cost, preventing importation, and, at the same time, its local cost is greater than the f.o.b. price, impeding exportation.

85 The opportunity costs are used to value all inputs and outputs that are intermediate products used in the production of some other good or service. For some final non-tradable goods and services, however, the concept of opportunity cost may not be applicable because it is consumption value that sets the economic value. In these instances, we will adopt the criterion of "willingness to pay" (also called "value in use").

86 See *Guide to cost-benefit analysis of investment projects*. European Union. The willingness-to-pay (WTP) approach allows the estimation of a money value through users' revealed preferences or stated preferences. Users' preferences can be observed either **indirectly**, by observing consumers' behaviour in a similar market, or **directly**, by administering ad hoc questionnaires (but this is often less reliable). For the evaluation of some outputs, when the WTP approach is not possible or relevant, long-run marginal cost (LRMC) should be used. LRMC can be the default accounting rule. Usually WTP is higher than LRMC in empirical estimates, and sometimes an average of the two is appropriate.

TABLE A5

Calculation of economic price of non-tradable service – domestic numeraire

Composition of haircut service	Proportion	MP (LCU)	CFs	EP (LCU)
VAT	10%	2	0	0
Tradables[a]	20%	4	1.2	4.8
Non-tradables	10%	2	1	2
Labour[b]	60%	12	0.73	8.7
	100%	**20**		**15.5**
		CF = 15.5/20 = 0.77		

[a] SERF applied in the conversion.
[b] SWRF applied in the conversion.

Alternatively, if the international price level numeraire is used, non-tradable goods and services might be estimated by applying to their market prices (net of taxes) the SCF (0.83) or – as in the previous example – through a more detailed disaggregation and conversion work. In this case, the calculation to follow is shown in table A6.

TABLE A6

Calculation of economic price of non-tradable service – international numeraire

Composition of haircut service	Proportion	MP (LCU)	CFs	EP (LCU)
VAT	10%	2	0	0
Tradables	20%	4	1	4
Non-tradables[a]	10%	2	0.83	1.6
Labour[b]	60%	12	0.73×0.83 = 0.6	7.2
	100%	**20**		**12.8**
		CF = 12.8/20 = 0.64		

[a] SCF applied in the conversion.
[b] SWRF×SCF applied in the conversion.

Combining the economic valuation of tradable and non-tradable goods and services – a numerical example

This example combines the procedures used so far in estimating the economic prices for traded and non-traded goods and services in both numeraires. Let's assume now that we want to calculate the economic price for machinery that is an output of the project and also an import substitute.

An analysis of the country's macroeconomic data leads us to establish the national indicators and conversion factors shown in table A7.

TABLE A7

Macroeconomic indicators and conversion factors

Official exchange rate (OER)	LCU/US$	20
Shadow exchange rate (SER)	LCU/US$	24
SERF = SER/OER	no	1.2
Standard conversion factor (SCF)[a]	no	0.83
Shadow wage rate factor (SWRF)[b]	no	0.73

[a] SCF applied in the conversion.
[b] SWRF×SCF applied in the conversion.

We can now calculate the economic price for the machinery while working with the domestic price numeraire. The data for the calculation of the import parity price are shown in table A8, and the procedure is shown in table A9.

TABLE A8

Costs for importing the item

Cost	US$	LCU
c.i.f. cost	350	
Import duties (5% c.i.f.)		525
Port handling		30
Transport port to market		90
Transport project to market		30

TABLE A9

Disaggregation and conversion procedure – domestic numeraire

	Proportion	Financial value	CF	Economic value
Composition of machinery at port				
Traded component[a]	100%		1.2	120
	CF would be equal to (120/100) =		**1.2**	
Price of machinery at port of entry		7,000	1.2	8,400
Composition of handling charges				
Traded component[a]	40%		1.2	48
Labour[b]	40%		0.73	29
Non-traded component	20%		1	20
	100%			**97**
	CF would be equal to (97/100) =		**0.97**	
Economic price of handling charges	30%		0.97	29
Composition of transport				
Tax	12%		0	0
Traded component[a]	20%		1.2	24
Labour[b]	20%		0.73	14.6
Non-traded component	48%		1	48
	100%			**86.6**
	CF would be equal to (86.6/100) =		**0.86**	
Economic price of transport Port to market	90%		0.86	77.4
Project to market	30%		0.86	25.8

[a] SERF applied to traded components.
[b] SWRF applied to labour components.

Therefore, the calculation for the IPP at market level can be performed as shown in table A10. Assuming that all project machinery (or similar goods) is equally taxed, the estimated CF could be applied to the market prices of all machinery to convert them into economic prices without having to repeat the steps below each time.

TABLE A10

Final calculation of the IPP – domestic numeraire

Import substitute output: Machinery	Financial price	Economic price	Steps	
			In financial analysis	In economic analysis
Value at port	7,000	8,400	CIF value × OER	CIF value × SER
Plus: Tax	350	0	5% of CIF	Tax excluded
Port handling	30	29	given	CF applied (0.97)
Transport (port to market)	90	77.4	given	CF applied (0.86)
Less: Transport (project to market)	30	25.8	given	CF applied (0.86)
Machinery value at project site	**7,440**	**8,480**		
Conversion factor (EP/FP)	**1.14**			

A similar procedure can be used to calculate the IPP of the machinery when an international price numeraire is used (see table A11 and table A12).

It is clear from this that CFs for the same machinery (see table A10 and table A12) are different. This should not come as a surprise, since the procedure aims at correcting either external distortions related to trade barriers and foreign exchange – in the case of the domestic numeraire – or internal distortions linked to taxation and internal regulations and inefficiencies in the case of the international numeraire. The gap between these CFs is a weighted average of all CFs adopted in the calculation process (SERF, SWRF and the detailed CF), where the weights are given by the proportion of tradable and non-tradable components that constitute the item under analysis.

TABLE A11

Disaggregation and conversion procedure – international numeraire

	Proportion	Financial value	CF	Economic value
Composition of machinery at port				
Traded component	100%		1	100
	CF would be equal to (100/100) =		**1**	
Price of machinery at port of entry		7,000	1	7,000
Composition of handling charges				
Traded component	40%		1	40
Labour[a]	40%		0.6	24
Non-traded component[b]	20%		0.83	16.6
	100%			**80.6**
	CF would be equal to (80.6/100) =		**0.86**	
Economic price of handling charges	30%		0.86	25.8
Composition of transport				
Tax	12%		0	0
Traded component[a]	20%		1	20
Labour[b]	20%		0.6	12
Non-traded component	48%		0.83	39.8
	100%			**71.8**
	CF would be equal to (71.8/100) =		**0.71**	
Economic price of transport				
Port to market	90%		0.71	63.9
Project to market	30%		0.71	21.3

[a] SWRF×SCF applied to labour components.
[b] SCF applied to non-traded components.

TABLE A12

Final calculation of the IPP – international numeraire

Import substitute output: Machinery	Financial price	Economic price	Steps	
			In financial analysis	In economic analysis
Value at port	7,000	7,000	CIF value × OER	CIF value × OER
Plus: Tax	350	0	5% of CIF	Tax excluded
Port handling	30	25.8	given	CF applied (0.86)
Transport (port to market)	90	63.9	given	CF applied (0.71)
Less: Transport (project to market)	30	21.3	given	CF applied (0.71)
Machinery value at project site	**7,440**	**7,111**		
Conversion factor (EP/FP)	**0.95**			

ANNEX II

Including EFA in IFAD projects

Common issues in the economic analysis of IFAD projects

A comprehensive review of more than 100 projects approved by IFAD in the last two years found the following most frequent errors in economic analysis.

Omission of externalities. Very few projects identified and/or quantified positive or negative externalities. Classical examples of externalities in economic literature come from agricultural production (beekeepers and fruit planters; water uses and downstream effects, etc.), but practically no IFAD projects have identified these economic effects. The most likely reason is that project analysts do not take into consideration the importance of these impacts (particularly on the environment).

Omission of the economic benefits of infrastructure and social components. Many IFAD projects have infrastructure components (rural roads, storage, etc.) as well as socially oriented components (water facilities, sanitary improvements, etc.), but very few have identified the economic benefits related to these investments. This is a clear underestimation of projects' economic benefits.

Phasing and methodologies for the aggregation of net incremental benefits and beneficiaries. In many projects, conceptual and calculation errors have occurred when aggregating the net economic benefits of farms and rural microenterprises. The errors include the incorrect calculation of the incremental flows (many projects confuse the WP situation and the "incremental situation"), lack of clear information in the matrix of incorporation of beneficiaries, duplication of flows, and incorrect allocation of data.

Double-counting of costs. Many projects present farm budgets that include both amortization amounts and the investments. This is a typical conceptual confusion of accounting rules and financial analysis criteria. More importantly, in many projects the economic analysis includes the aggregated costs of the incremental investments and input costs twice. In this case, the typical error consists of including "all project costs" (extracted from COSTAB) in the outflows when many of these items have already been included in the aggregation of net farm incremental benefits.

Incorrect selection of shadow prices. Most projects do not use shadow prices. Some projects adjust market wages without major justifications. Very few projects adjust the market prices of traded and tradable goods. There are practically no occurrences of sound economic justifications for the adoption of the selected shadow prices.

Non-pertinent sensitivity analysis and lack of switching values. Sensitivity analysis is usually performed without any relation to the identified risks of the project. In addition, almost no sensitivity analyses include the calculation of switching values, and therefore, there is no clear identification of the most critical variables of the project.

TABLE A13

Tables to include in the EFA documents

Inputs for financial analysis (WOP and WP situations)	Information to include
Crop budgets and models	▶ In technical coefficients and units. ▶ In monetary terms (financial prices of outputs and inputs).
Activity models and budgets	▶ In technical coefficients and units. ▶ In monetary terms (financial prices of outputs and inputs).
Farm models and budgets (rural microenterprises' models if needed)	▶ In technical coefficients and units. ▶ In monetary terms (financial prices of outputs and inputs). ▶ Cash flow (Y0 to Y20) and phasing of benefits.
Farm/activity models summary results (rural microenterprises' budgets if needed)	▶ WOP/WP and incremental scenarios. ▶ Indicators of financial profitability (FIRR, FNPV). ▶ List of assumptions and justification of the financial discount rate; other indicators: net incomes in the WP situation vs. income poverty line; returns to labour; returns to land, etc. ▶ Financial sustainability analysis.

Inputs for economic analysis	Presentation
Matrix of incorporation of beneficiaries	▶ Per farm/activity model and by year.
List of shadow prices	▶ Clear identification of indirect taxes and subsidies. ▶ Correction of financial prices. – For tradable and non-tradable goods – Labour – Foreign exchange – Social discount rate ▶ Figures and sound economic justification for each one.
List of economic prices	Show calculations of economic prices: conversion of financial prices by means of the shadow prices.
Aggregation of net incremental economic benefits	▶ Complete table of project economic analysis. ▶ Economic profitability indicators (ENPV, EIRR).
Sensitivity analysis and switching values	▶ Variations in costs and benefits (10%, 15%, 30%). ▶ Short paragraph linking SA with risk analysis.

TABLE A14

Checklist for the review of EFA documents

Total project cost by components	Are resources distributed according to project priorities?
Beneficiaries	Does total amount of ha/acres and beneficiaries correspond to project assumptions?
Cost per beneficiary	Is it in line with regional local averages?
EFA & LogFrame: are indicators in line with EFA assumptions?	**Goal:** Number of beneficiaries adopting proposed interventions (uptake) **Dev. Objective:** percentage HH increased assets **Outcome C1:** percentage farmers with percentage yields increase **Output C1:** number of irrigation schemes in place
EFA adoption rates – Link with LOGFRAME	Check coherence with uptake rates and phasing of project costs in COSTAB
Economic analysis (from the government perspective): Is the investment efficient for the economy as a whole?	
Should the government allocate its resources to this project?	
NPV/EIRR	A **social discount rate** is used as opportunity costs for the government
Efficient allocation of resources	Are unit costs realistic? Can we assess returns on investment per component?
Social and environmental externalities	Are efforts made to include them?
Shadow prices	Are justifications realistic; do they explain application of SERF or SCF?
SWR applied to labour	
SERF or SCF applied to main outputs	
SERF or SCF applied to main inputs	
Financial analysis (from the farmer/producer point of view)	
Should the farmer invest in the activities promoted by the project? Technical models based on realistic parameters	
Revenues at full development by model	Include self-consumption
List investment and operating costs	Include also family labour
Net incremental benefits at full development	WP-WOP (always WOP≠0)
FNPV/FIRR/BCR by model	Is the technical proposal viable? Market opportunity costs are used as discount rate
Could the farmer invest in these activities?	
Are **family incomes** enough to cover investment and working capital requirements?	Family incomes (proxy) = Net benefits + family labour
Are family incomes above the poverty line?	
Are there any other sources of income?	Remittances; off-farm wages
Who is paying? Are there any financing needs?	
Will the farmer invest in these activities?	
If family incomes are not sufficient to cover investment or/and working capital requirements, which provisions are being envisaged by the project? Incremental costs and labour are affordable for the HH?	
Labour requirements	Are the working requirements realistic?
Investment requirements	Financing scheme/grant?
Working capital requirements	Who is financing? How?
Returns to labour	Returns to labour > unskilled salary
Value chain projects	
Verify NIB at different levels of the value chain	Is this a pro-poor project?
Employment created?	Are the jobs good-quality/sustainable?

Practical tips

EFA in implementation

Current practice

There is broad consensus that EFA should be used more during implementation, but this review showed that EFA generally receives rather scant attention after projects pass through the quality assessment at the design process. In particular:

- **Supervision missions.** Supervision reports rarely review or update the financial analysis and almost never touch on economic analysis. This is understandable, given that the supervision guidelines do not call for this to be done, and CPMs report that supervision budgetary and time constraints would make it very difficult to accommodate.
- **Midterm reviews.** Of the ten MTRs sampled, three offered anecdotal evidence of financial and economic impacts but none reviewed the original farm models or economic analysis. One, Malawi (2010)[87] undertook an *ex ante* financial and economic analysis of activities to be undertaken during the remaining life of the project based on evidence accrued so far. China (2008)[88] undertook the financial analysis of two farm models proposed as new interventions during the MTR, and Sudan (2004)[89] presented an economic analysis of a proposal to extend the length of a rural road. The generic MTR terms of reference presented in IFAD's 2002 Guidelines for M&E do not suggest that the EFA should be reviewed or updated, although there is mention of clarifying the assumptions and risks and assessing efficiency and effectiveness as well as results and impacts. Most of the MTRs follow the supervision report format and are basically supervision reports with some additional detail.
- **Project completion reports.** IFAD's Guidelines for project completion (see box A1) state that the EFA should be reworked as part of PCR preparation. However, a review of a sample of 10 PCRs found that this is not always done. Only two PCRs, China (2008)[90] and Cambodia (2012),[91] presented a full economic and financial analysis. The China analysis directly compared the results with design estimates. But in both cases, the analysis was based on information gathered by the PCR team, rather than by the project M&E system. Bangladesh (2012)[92] presented a financial analysis but not an economic analysis, and no EFA was undertaken during design, so design/actual comparison is not possible. Several others presented fragmented and anecdotal evidence on financial impacts at the farm household level,

BOX A1

Guidelines for project completion (2006)

The Guidelines call for a revised financial and economic analysis, including calculation of financial and economic rates of return based on actual costs, and estimation of actual benefits based on M&E data. Specifically:

"The PCR should address, at a minimum the costs and benefits of the project. The PCR therefore needs to include a recalculation of the economic rate of return showing actual costs by component and an updated estimation of projected benefits, reflecting changes made during implementation, actual coverage and any changes in economic prices and market conditions. The analysis should include a discussion on the impact on NPV/ROR of varying the most critical underlying parameters (such as inputs, world prices, yields). The sensitivity analysis should be based on alternative scenarios associated with specific risks, rather than a mechanical xx per cent change in costs".

87 Rural Livelihoods Support Programme.

88 Environment Conservation and Poverty Reduction Programme.

89 North Kordofan Rural Development Project.

90 Qinling Mountain Area Poverty Alleviation Project.

91 Rural Poverty Reduction Project in Prey Veng and Svay Rieng.

92 Microfinance for Marginal and Small Farmers Project.

but the remainder were virtually silent about financial and economic impacts. In almost all cases, the reports noted the failure of the project M&E systems to generate the data needed to complete the EFA at project completion. These IGs reinforce the recommendation made in IFAD's Guidelines concerning the use of EFA during the preparation of the PCR.

- **Project evaluations.** IOE undertakes a desk review of all PCRs – some 20 to 30 per year – and produces a PCR Validation (PCR-V) report. As has been noted, most PCRs do not include a full EFA, and only a few go as far as financial analysis. The PCR-V process is fairly superficial, with only 11 staff-days allocated for each project, so if a complete EFA is not included in the PCR there is not much that IOE can do to remedy the situation. This is due to one or more of the following: (a) the lack of a sound EFA (or, indeed, any EFA) in the project design document to provide a basis for subsequent reassessment; (b) no or poorly conducted baseline surveys, or loss of the data collected; (c) systemic failure of M&E systems to gather and analyse information at output and outcome levels; and (d) as a consequence of (a)-(c), very weak or non-existent project completion impact assessments.
- **Annual report on results and impact.** The ARRI draws together the results of a number of project, country and thematic evaluations and makes an annual assessment of IFAD's overall performance according to the standard evaluation criteria: relevance, effectiveness, efficiency, impact and sustainability. Economic and financial considerations are key to estimating efficiency and impact, respectively, according to the IOE definitions (see box A2). However, the general lack of hard evidence by which to gauge these measures means that the ARRI is based almost entirely on a ranking of projects using non-quantitative measures.

It is clear, then, that current practices generally fail to give adequate consideration to EFA after project design and the QE/QA approval processes. This has several important consequences. First, opportunities are being missed to refine and modify projects during implementation according to the economic and financial results being generated (or not). Second, the systemic failure of project M&E systems is limiting the capacity to conduct rigorous EFAs at the project completion or evaluation stages. And third, this makes it difficult for IFAD to make credible, evidence-based claims about the economic and financial results arising from its operations.

Desirable approach

To address the shortcomings discussed above, a number of EFA tasks need to be undertaken at every stage of the project cycle, from inception to *ex post* evaluation, and a number that vary according to the stage of the project cycle at which a revision of the EFA can be made. All are dependent to a large extent on the quality of the EFA carried out during project design and on the effectiveness of project M&E systems. If the economic logic of the design is clearly articulated and reflected in quantified performance indicators, and if the M&E system works reasonably well, then EFA during the implementation phase is relatively easy. Conversely,

BOX A2

Efficiency and impact

- Efficiency is a measure of how economically resources/inputs (funds, expertise, time, etc.) are converted into results at different levels, including outputs and impacts.
- Impact is defined as the changes that have occurred or are expected to occur in the lives of poor rural people (whether positive or negative, direct or indirect, intended or unintended) as a result of development interventions.

weak design logic that is not supported by realistic farm models and performance indicators may require a significant amount of remedial effort during the early stages of implementation. At all stages of the project cycle there should be a continuous review and refinement of the EFA as part of the M&E and knowledge management functions, to inform decisions about adjustments to the design and implementation modalities in pursuit of the project objectives. This review and refinement involves some or all of the following measures.

- Assessing the validity of the assumptions incorporated in the original EFA. Over the life of a project, substantial changes in the economic context may render some of the original assumptions invalid and/or suggest new ones that need to be considered.
- Continuously reviewing the risks and mitigation measures to be applied in light of changing circumstances. Repeat the sensitivity analysis to help identify emerging risks to project performance and assess their importance.
- Through the M&E system and special studies, gathering and analysing evidence about project achievements and impacts. Identify what is working and what is not, and consider discontinuing things that are not working and scaling up those that are.
- Comparing actual costs with the design estimates. Significant deviations due to under-/overestimation or unexpected price changes may have implications for the financial and economic impacts, requiring design adjustments and reallocation of resources between components and/or expenditure categories.
- Assessing project beneficiaries' participation and adoption rates and revising farm models accordingly, taking new technologies into consideration.
- Monitoring changes in the key economic parameters, such as taxes, subsidies, conversion factors and shadow prices. Generally, these parameters are applied to all projects included in the country programme, and they should be consistent with the parameters used by the national planning authorities and other development partners.
- Updating the EFA from time to time as circumstances change and the M&E system provides evidence of project outputs, outcomes and impacts. The updated EFA is intended to inform continuous refinements to the project design and is also useful for country and regional portfolio reviews and COSOP monitoring.

Approach by project cycle phase

Table A13 shows the approach to these activities may vary according to the phase of the implementation cycle.

TABLE A15
Approach by project cycle phase

Phase	Approach
Project inception	▶ Project launch and inception workshop: ensure that all stakeholders understand what economic and financial results the project aims to achieve and how these results should be monitored and evaluated. ▶ Finalization of the Project Implementation Manual: ensure that the procedures are in place to measure changes at the household level so that these can be aggregated to estimate whole-project economic and financial results. These procedures will form part of the project M&E system. ▶ Ensure that the baseline survey defines the current levels of productivity and profitability in target households to enable construction of "before-project" farm financial models.
Supervision – early stage	▶ During the first year or two of a project, supervision missions generally focus on implementation procedures and systems and help address implementation bottlenecks. ▶ The early-stage supervision missions are mainly concerned with inputs and activities, since it is usually too soon to see much evidence of outputs, outcomes and impacts. ▶ The early missions should, however, monitor changes in the assumptions used in the project design EFA, their possible impact on economic and financial results, and the implications for the project.
Midterm review	▶ By the time of the MTR, most projects are expected to be generating significant outputs, which are being detected and measured by the M&E system (RIMS Level 1 indicators). ▶ The MTR team should be looking for evidence that the project is delivering, or is likely to deliver, the economic and financial benefits envisaged in the design. Changes in beneficiary attitudes and behaviour (e.g., adoption of new technologies or increased value addition) are important indicators that the project is likely to produce the anticipated benefits. ▶ Changes in the key economic parameters (prices, costs, exchange rates, conversion factors, taxes, subsidies, etc.) need to be monitored. ▶ The MTR team should include a person with EFA skills who is able to rework the project design EFA on the basis of results generated during the first half of the project life, and make recommendations on ways to improve financial and economic impacts. ▶ The terms of reference for MTR missions should ensure that economic and financial issues receive adequate attention and are used to inform decisions about the future direction of the project.
Supervision – later stages	▶ Later-stage supervision missions should continue to monitor inputs and outputs, but should also look for signs of improving financial outcomes at the household level (using the RIMS Level 2 indicators), as well as economic outcomes at thenational level. ▶ New technologies and market opportunities, changing policies and institutional arrangements, and many other factors may suggest further refinements to the project design to achieve better economic and financial outcomes. ▶ Economic and financial considerations during the later supervision missions will contribute to lessons learned – with implications for scaling up, the country strategy (COSOP) and the design of future projects.

Phase	Approach
Project Completion Report	▶ At the PCR stage, there should be a comprehensive analysis of financial and economic impacts at the household and national levels, respectively, using the RIMS Level 3 indicators. ▶ The PCR should also trace the chain of causality in economic and financial results to demonstrate that the observed improvements in the lives of the beneficiaries are attributable (at least partly) to the outputs and outcomes generated by the project. ▶ This calls for reworking the EFA on the basis of actual project performance. It should be noted, however, that the analysis will still be at least partly *ex ante* since the benefit stream is usually expected to continue well beyond project completion. ▶ The PCR normally highlights implications for the country strategy (COSOP) and the design of future projects, with emphasis on how economic and financial outcomes can be strengthened.
Ex-post evaluation	▶ Ex-post evaluations are undertaken by IOE for a sample of IFAD projects, usually a few years after project completion. ▶ In some cases, this involves reworking the EFA on the basis of evidence about post-project benefit streams and the degree to which they have been sustained.

Common misunderstandings and how to avoid them

EFA during project implementation is not intended to be mandatory; rather, it is intended to be used selectively to inform decision-making during project implementation. EFA is only mandatory (a) during project formulation; (b) as part of the PCR; and (c) for project performance assessment by IOE.

EFA cannot be undertaken properly at project completion unless there has been a robust EFA at the project design phase, a baseline survey, and an M&E system that generates empirical data on results and impacts. In most IFAD projects, one or more of these requirements are less than fully satisfactory, which means that most PCRs and project evaluations do not include rigorous EFA.

EFA during project implementation should not add to the workload of CPMs and supervision missions. It is very much the responsibility of the project implementing agencies. IFAD can provide technical backstopping and capacity-building support, but the work has to be done by the projects, not by IFAD. However, it is essential that projects and their implementing agencies be provided with the resources and expertise they need to perform this function.

Financial analysis is usually sufficient for monitoring purposes during implementation. If a project is delivering strong financial results for its beneficiaries, it is highly likely that there will also be positive economic impacts. The reverse is also true – there can be no significant economic impacts unless there are financial benefits at the household level first.

Attribution is an issue for M&E in general, and by implication for EFA. It is not generally possible to attribute financial and economic benefits entirely to project interventions, since many non-project factors may also contribute. It is preferable to think in terms of contribution – that project investments contribute to the generation of project benefits – looking for evidence of contribution rather than proof of attribution.

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Summary steps in financial and economic analysis

Steps in financial analysis

The typical sequence of tasks to be undertaken in financial analysis is the following:

1. Develop farm/enterprise models and identify benefits and costs (investment and recurrent) for WOP and WP scenarios (based on crop budgets).
2. Compare the discounted flows of benefits and costs and calculate the differences between the obtained results and the WOP scenario in order to determine the net incremental benefits (NIB) of the proposed interventions.
3. Calculate the project financial profitability indicators of each model (i.e., financial NPV, financial IRR and B/C ratio), applying these investment criteria to make an investment decision (positive or negative).
4. Assess family incomes and establish financing/credit needs by performing a “sustainability analysis”.

Steps in economic analysis

Economic analysis requires assessment of a project’s net impact on economic welfare by considering:

5. Convert all market prices into economic/shadow prices (SP) that better reflect the social opportunity cost of the good.
6. Remove transfer payments (taxes and subsidies) and quantify externalities (positive and negative).
7. Aggregate all models’ NIB cash flows, respecting incorporation phasing patterns of targeted beneficiaries into project’s activities.
8. Compare aggregated benefits with other project costs to obtain incremental discounted cash flows. Calculate economic performance indicators adopting a social discount rate: ENPV, ERR, B/C ratio.
9. Perform sensitivity analysis (SA) in order to deal with the main risks and uncertainties that could affect the proposed project.

EFA step by step

Financial analysis

1 WP-WOP develop and identify

Develop farm/enterprise models and identify benefits and costs (investment and recurrent) for WOP and WP scenarios (based on crop budgets).

2 Discount flows – costs and benefit

Compare the discounted flows of benefits and costs and calculate the differences between the obtained results and the WOP scenario in order to determine the net incremental benefits (NIB) of the proposed interventions.

3 Calculate indicators

Calculate the project financial profitability indicators of each model (i.e. financial NPV, financial IRR and B/C ratio), applying these criteria to make an investment decision.

4 Financial sustainability

Assess family incomes and establish credit needs by performing a 'sustainability analysis'.

Economic analysis

5 Shadow prices

Convert all market prices into economic/shadow prices (SP) that better reflect the social opportunity cost of the good.

6 Transfers and externalities

Deduct taxes and subsidies – Consider positive and negative externalities.

7 Aggregation

Aggregate all model's NIB cash flows respecting incorporation phasing patterns of targeted beneficiaries.

8 Cash flows

Compare aggregated benefits with other project costs to obtain incremental discounted cash flows. Calculate economic performance indicators adopting a social discount rate: ENPV, ERR, B/C ratio.

9 Perform sensitivity analysis

in order to deal with the main risks and uncertainties that could affect the proposed project

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