# Internal Guidelines for Economic and Financial Analysis of Rural Investment Projects at IFAD

## PTA

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# Contents

# Internal Guidelines for Economic and Financial Analysis of Rural Investment Projects at IFAD

## *I. Introduction*

### *Background*

1. Since the Quality Enhancement (QE) process was established in 2008, project reviewers at both the Quality Enhancement and Quality Assurance (QA) stages have repeatedly identified areas of weakness in IFAD's use of Economic and Financial Analysis (EFA) in project design. For example, of the 38 projects which QE has reviewed during 2011, 8% had not submitted an EFA and in 61% of the cases EFA issues were identified; at the QA stage, recommendations have surfaced for 20% of the projects1.

2. The specific areas of concern range from technical considerations regarding the *quality of the analyses and data* (poor assumptions, poor presentation of the analysis and technical issues such as the use of shadow pricing, conversion factors, and discount rates) to broader issues regarding the *use of EFA as a tool* in project design (activity selection, logframe design, risk analysis) and project implementation.

3. As a first step to face this issue, the Policy and Technical Advisory Division (PTA), in collaboration with the QA Secretariat, organised a workshop (October 2011) with international experts and practitioners involved in projects´ EFA to establish a consensus regarding internationally accepted standards and best practice. Among the main recommendations from the Workshop2, the need for the formulation of IFAD's projects Internal Guidelines for EFA (IG) emerged.3 It was suggested that the IG should: (a) Be directed to: staff and practitioners in charge of developing the EFA as well as reviewers and advisers to know what to expect from these analysis (b) be simple and hands- on including minimum criteria for the undertaking of EFA illustrated by good examples for each category of projects; (c) provide standards on how to present assumptions and findings, and definitions on how to select the discount rate to use, how to include externalities, how to apply shadow prices and/or Conversion Factors CF/ justifications, etc. and (d) contain recommendations on how to present basic data, tables and calculations as well as which information to include in Project Design Documents, its Annexes and Working papers.

4. This document presents the first version of the Internal Guidelines for EFA of rural investment projects at IFAD.

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[1] EFA used to be much more common in IFAD designs from its inception. However, a shift away from production-oriented programmes towards community-based and capacity-based projects in the 1990s changed the degree to which designs were expected to have and use robust EFA. With value chains now emerging as a focus, the trend is shifting back toward a more classical approach to EFA.

[2] See Appendix 1 to this document.

[3] The IFAD Learning Notes (2007) from Section KSF 3 (3.6) include a complete set of general recommendations for the undertaking of EFA. It appears that a more detailed and focused approach to project analysts when performing EFA of IFAD projects is needed.

### *Scope*

5. The main scope of the IG is to help the CPMs, Missions Team leaders and EFA consultants in the performance of their tasks related to EFA of IFAD projects' design. The IG should be considered as an "open and dynamic" document that will be updated on a regular basis introducing changes and/or complementing information following the needs of the main users.

6. The IG is, *per definitio*, an auxiliary methodological tool for the undertaking of EFA requirements at IFAD. They do not pretend to substitute the contents of the large bibliography on EFA and CBA developed by academics and/or other IFIs which is expected to be consulted by analysts of IFAD projects.[4]

7. Finally, any project analyst should rely on his/her best judgment accumulated through experience when making decisions on the methodology and the assumptions to be used. This IG, as any other manual, is not a substitute for these indispensable qualities. It is hoped, however, that it will help to reduce the scope of subjective judgment in project economic and financial analysis as well as bring some standardization in the presentation of results.

### *Outline*

8. The guidelines are divided in **5 Sections**. After the Introduction, **Section II** highlights the Relevance of Economic and Financial Analysis for investment projects in general, to introduce some basic technical concepts and to describe, briefly, the process of EFA of investment projects. **Section III** focuses on the specificities of IFAD Rural Investment Projects as well as explaining the different uses the EFA can have in design, implementation and supervision of development projects. The next part, **Section IV**, is the core of this IG, describing minimum requirements through the performance of a complete EFA for an IFAD´s typical rural investment project. All detailed steps of the analysis are described and illustrated with an "ad hoc" example "*The Guideland on Rural Development Project*". Finally, **Section V** addresses the main issues related to Complementary and Alternative Methodologies for performing EFA on projects (and/or project components) not directly related to production or productivity objectives.

### *How to read this guideline*

9. The IGs are directed to three different audiences: 1) to CPMs, regional economist and portfolio advisers that are interested in understanding the basic concepts of an EFA and would like to know what to expect from this type of analysis in terms of use of the produced information, i.e. how the EFA assumptions are also benchmarks and indicators of success in the logframe; how the sensitivity analysis provides useful information to address mitigation measures in the risk assessment sections; etc. For this public, reading Sections II and III and VI will provide all necessary information. 2) Section IV and V are directed to the economists performing the actual EFA; here he/she will find a practical example describing all expected steps to be followed in the analysis as well as tables to be prepared and presented. We have also provided some classical mistakes to be avoided as well as solutions to the most frequent questions about discount rates, shadow prices etc. 3) the third audience are project design's quality reviewers that will find in the IGs the minimum requirements for quality standards of a classical EFA and, in Section V, some basic requirements to be expected from special cases on Complementary and Alternative Methodologies, acknowledging however that there will always be a more desirable analysis to be performed to these type of projects.

[4] See List of available bibliography.

## *II. Relevance of EFA of investment projects*

### *Project and Investment Project*

10. A project can be defined as an operation comprising a series of works, activities or services intended to accomplish an indivisible task of a precise economic or technical nature; one which has well defined goals.[5] Whenever a project implies the decision of sinking present economic resources (i.e. productive capital, infrastructure, human capital, knowledge, etc.) in the hope of future benefits, betting on the distant and uncertain future horizon, **it is an investment project**. In brief, **an investment project** is the decision to make some current expenses in the hope of future benefits.

11. **IFAD ´s main activity is the financing of investment projects**. It also provides financing (i.e. grants) to institutions and organizations with the aim of strengthening the technical and institutional capacities in the domain of agricultural development. Grants are limited to 10% of the combined loan and grant programme[6].

### *Relevance of EFA.*

12. EFA of investment projects is a basic requirement for decision making on project investment and financing. Nowadays, all International Financing Institutions (IFIs) require EFA of projects in order to make decisions on project financing. IFAD included, from the very beginning, the need to ensure the economic and financial viability of its operations (See Agreement Establishing IFAD, Article 7, Section I (d))[7] and IFAD Lending Policies and Criteria (III (26)).[8]

13. EFA makes use, as a major methodological tool, of the Cost Benefit Analysis (CBA) [9] but it also allows for other approaches and studies, for example, cost-effectiveness and multi-criteria analyses, if the project is likely to have significant non-monetary effects and/or the identification and valuation of benefits is extremely difficult[10].

14. The broad purpose of the EFA is to ensure an efficient allocation of resources, proving to society the convenience of implementing a particular investment instead of other options (including the "doing nothing" alternative). In brief, **EFA is the most appropriate tool for appraising the convenience of carrying out a project for both, the direct beneficiaries and the national economy as a whole.**

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[5] Extracted from: "Guide to cost benefit analysis of investment projects. European Union". Similar definitions can be found in several manuals and related bibliography.

[6] IFAD operations, website 2012.

[7] "…eligibility for assistance shall be on the basis of objective economic and social criteria…"

[8] "The Fund, taking due account of ….. the principle of economic viability of projects…".

[9] The theoretical origins of cost-benefit analysis (CBA) date back to issues in infrastructure appraisal in France in the 19th century. After World War II, there was pressure for "efficiency in government" and the search was on for ways to ensure that public funds were efficiently used in major public investments. This resulted in the beginnings of the fusion of the new welfare economics, which was essentially cost-benefit analysis, and practical decision-making. Since the 1960s CBA has been recognized as the major appraisal technique for public investments and public policy.

[10] See section III for a summary of quantifiable benefits and section V of this guideline for practical examples.

### *Requirements for EFA: technical and institutional viability.*

15. Economic and financial analysis is only one part of the overall analysis of the project; it takes for granted that the project is technically sound and its institutional arrangements will be effective during implementation. Therefore, the undertaking of EFA of investment projects requires, at least, for the project under analysis to be feasible from a technical and institutional point of view.[11] This is a "strong" assumption since the review of numerous cases has shown many inconsistencies in project's technical formulation[12].

16. Hence, the review of the technical proposals and the institutional arrangements for project implementation is a previous step to EFA. Generally speaking, the preparation of an adequate project Logframe (for each stage of the project cycle) is a powerful tool to avoid this type of inconsistencies (See Section VI below for additional information on the links between Logframe and EFA).

### *Basic concepts for carrying out an EFA*

17. In order to appraise the economic and financial convenience of any investment project, what is needed to be assessed is the contribution of project's envisaged activities to the present situation. In other words, what we need to compare are the situations "with" and "without" the project. Therefore, the first step is the description of the baseline scenario or counterfactual scenario which represents the term of comparison in order to evaluate project impacts. This will usually be a forecast of the future scenario without the project, i.e. the 'business as usual' (BAU) forecast.

18. The second step is the formulation of the project expected outcomes in the future (i.e. Investment costs, operating costs and benefits). Because costs and benefits do not occur at the same time, generally with cost preceding and exceeding benefits during the first years of the project, the comparison is not straightforward and hence, "discounting techniques" are applied. This issue arises in both economic and financial analysis.

19. Discounting is essentially a technique that enables to compare the value of money in different time periods. A dollar received today is worth more than a dollar received tomorrow. The fact that we have to postpone consumption makes tomorrow's dollar less valuable than

[11] Rigorously speaking, the requirement is valid for, at least, one technical and institutional option. As it will be seen, the application of EFA during project formulation will also help to identify and select the "best" project technical and institutional alternative.

[12] Common identified inconsistencies are: (a) incomplete addressing of identified constraints for productive development. For example: (i) the project proposes the provision of extension services to introduce better technologies but there is no assessment of the on-farm investments and working capital requirements for adopting the proposed technologies and, consequently no inclusion of required components (i.e. grants, credit, etc.) ; (ii) The project proposes huge investments in irrigation facilities but no provision is made for the required technological transfer services and on-farm investments and working capital; (iii) the project proposes the improvement of rural financial services but there are no descriptions of the expected productive activities and technologies to be adopted by means of these facilities; etc. (b) Incomplete or inadequate description of the institutional arrangements for carrying out the proposed project components. Etc.

today's. How much is $1 received in **n** years, worth today? The answer depends on the adopted discount rate **( r)** and the "discount period" **(n)**.[13]

20. Therefore, the aggregation of project flows occurring during different years requires the adoption of an appropriate discount rate[14] in order to calculate the present value of the future flows as well as the definition of the period of discount (also called "project economic life" or "time horizon analysis")...

21. Usually, the discount period is equivalent to the technical "useful life" of the largest investment components of the project. This rule might change when: (i) technological progress would turn obsolete the investments before their useful life; (ii) the investment period is "too long" (i.e. very common in environmental projects, ship construction, etc.); (iii) there are another factors (i.e. legal, institutional, etc.) that justify another specific choice of the discount period.[15]

22. The third step is the determination of the project net flows (i.e. financial and/or economic)[16] that should be based on the *incremental approach*, which result from comparing the situation with the project and the situation without the project.

23. With these elements, it is possible to calculate the corresponding project profitability indicators.

### *Investment criteria: profitability indicators*

24. Generally speaking, a project is considered "feasible" or "convenient" if the sum of expected incremental benefits is larger than all investment costs. This can be assessed through "profitability indicators". The typical "profitability indicators" for investment projects are:

(i) The net present value (NPV)
(ii) The internal rate of return (IRR)
(iii) The benefit/cost ratio (B/C)

(i) The **net present value (NPV)** indicator, defined as the sum that result when the expected costs of the investment are deducted from the discounted value of the expected benefits (revenues), is calculated through the following formula:

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} - It$$

Where:

$B_t$ = benefits at time $t$ $C_t$ = costs at time $t$ $It$= investment costs

$n$ = project economic life $r$ = discount rate

Whenever **NPV >0,** the project is considered feasible or profitable.

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[13] The Present value (PV) = Future Value/(1+r)n . If r=10% and n=8 years, the present value of $1 would be $ 0.51.

[14] For detailed information on the determination of adequate rates of discount, see Section IV below

[15] For more information, see Section IV below.

[16] See below for understanding the differences between them.

(ii) **The internal rate of return (IRR)** indicator is defined as the discount rate that produces a zero NPV. It is compared with a benchmark ***r*** (usually equal to the chosen rate of discount) in order to evaluate the project performance. It is calculated through:

$$0 = NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} - It$$

IRR = (r* ,NPV = 0).

For the project to be profitable the IRR has to be greater than the interest rate that could be earned in alternative investments, thus, whenever IRR> ***r*** the project is considered feasible.

If the (alternative) interest rate in the market is lower than the IRR, the NPV is positive, and vice versa:

- IRR > r = $i^{mkt}$ → NPV > 0 - IRR < r = $i^{mkt}$ → NPV < 0

(iii) The **benefit/cost ratio (B/C)** indicator: it is the ratio of the present value of benefits to the present value of costs over the time horizon.

$$\frac{B}{C} = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - I_0} = \frac{PV(B)}{PV(C)}$$

If, **B/C ≥1,** the project is **accepted.** If **B/C <1** the project is **rejected.**

25. All these profitability indicators are based on calculations from the same flows of benefits and costs: the flows of **incremental net benefits** of the proposed investment.

26. **The most appropriate indicator for appraising an investment project is the NPV** as the investment decision criterion is straightforward: **if NPV is >0,** the project is feasible. It means that **the proposed investment is a profitable alternative in terms of resource allocations,** it is better than the present and "without project" situations and also better than allocating the same resources to other economic activities which will yield the average rate of profit[17]. NPV can always be calculated with the available information inputs for a given investment (i.e. the flow of net incremental benefits).

[17] The rate of discount is also considered a "proxy" of the average opportunity cost of capital (profit rate), both in financial and economic terms.

27. Yet, the IRR is the profitability indicator most commonly used for assessing investment projects. Probably, this is due to the fact that IRR can be easily compared with indicators of profitability like interest rate (**r**) or rates of profit in alternative allocations. Hence, the decision criterion is: if **IRR > r** the project is feasible (**r** being the interest rate used as reference or discount rate). However, in certain cases, the calculation of IRR is not possible, hence making it impossible to be used as profitability indicator: (a) when the flow of net incremental benefits does not have a negative element; (b) when the flow of net incremental benefits presents more than one IRR complicating the decision on which one to considered as profitability indicator; etc. [18]

28. The B/C ratio provides some advantages only when is necessary to formulate a "ranking" of alternative investment projects under budget constraints.

### *The process of EFA: Economic and Financial differences, a brief presentation*

29. Conducting a well-executed EFA requires the analyst to follow a logical sequence of steps. The first set of steps is part of the "Financial analysis"; the second set of steps of the Economic analysis".

30. It is important to understand the distinction between financial analysis and economic or cost-benefit analysis. This distinction is closely related to the identification of costs and benefits as well as their valuation. Generally speaking, the notion of "benefits" and "costs" depends on the "point of view" or the so-called "standing issue". From the point of view of the "economy or society as a whole", the costs and benefits that count are different from those of the private sector:

- The "private investors"[19] considers exclusively the costs and benefits related with the financial analysis of the project.

31. The analysis from an economic point of view will consider: (a) the "externalities" (positive and negative) to be produced by project's activities; (b) the removal of transfer costs (i.e. subsidies and taxes); (c) that costs and benefits should be valued by their opportunity costs and nor by their market price.

32. Thus**,** the **financial analysis** will considers the project from the point of view of the stakeholders that participate to the investment with risk capital, the wealth created by a project in "*n"* periods of time can be defined as the Net Financial Present Value (NFPV) of the investment

[18]There is general agreement that the internal rate of return (IRR) should not be used to rank and select mutually exclusive projects. Where a project is the only alternative proposal to the status quo, the issue is whether the IRR provides worthwhile additional information. Views differ in this respect. Some argue that there is little merit in calculating a statistic that is either misleading or subservient to the NPV. Others see a role for the IRR in providing a clear signal as regards the sensitivity of a project's net benefits to the discount rate. Yet, whichever perspective is taken, this does not alter the broad conclusion about the general primacy of the NPV rule.

[19] This "point of view" is also applied to the "executing agency" of a public project.

produced by the project. The **economic or cost-benefit analysis** looks at the overall impact of the project options on the economic welfare of the entire society. It`s the analysis carried out from the point of view of the collective agent (e.g. national community), the wealth created by a project in n periods of time can be defined as the Net Economic Present Value (NEPV) of the investment produced by the project.

**Box No 1: Financial Analysis – elements of the analysis**

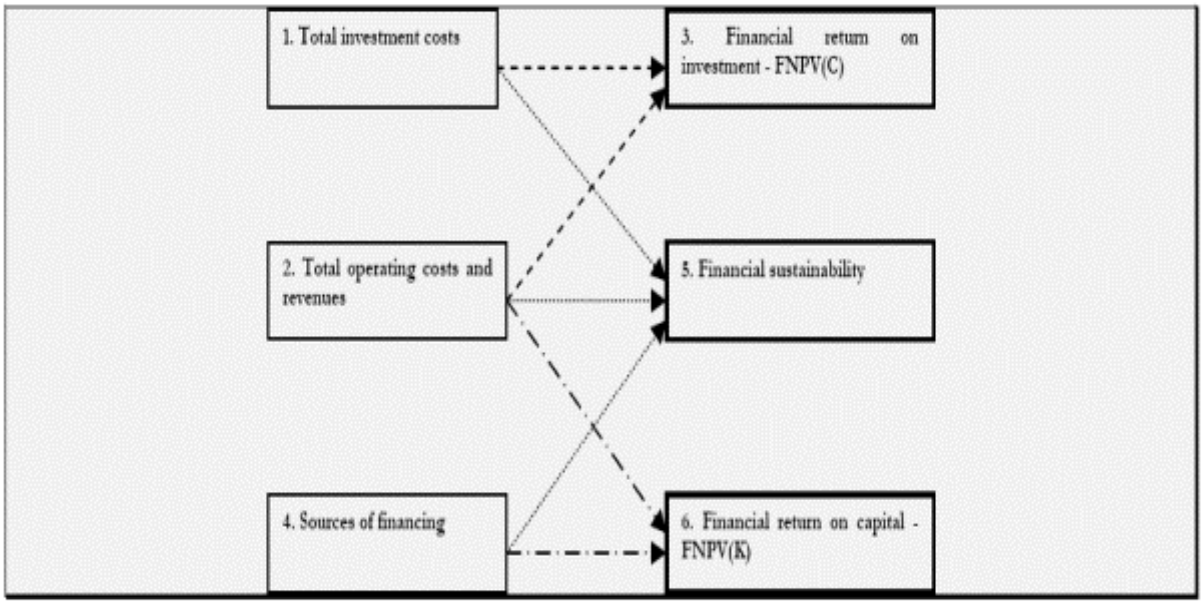
It should be based on the discounted cash flow approach. A system of accounting tables should show project cash inflows and outflows related to:

- total investment costs;
- total operating costs and revenues;
- financial profitability indicators on the investment costs: FNPV and FRR;
- sources of finance (financing plan);
- financial sustainability;

**In the financial analysis, all costs and benefits should be valued at "market prices**". Only cash inflows and outflows are considered (depreciation, reserves and other accounting items which do not correspond to actual flows are disregarded).

33. A detailed description of these steps is provided in Section IV of this IG which presents a complete EFA of "typical" IFAD production-oriented projects.

**Graph 1: Scheme of the Financial Analysis**




Source: Guide to cost benefit analysis of investment projects. European Union.

**Box No 2: Steps for a Financial Analysis of an Investment Project**

**The typical sequence of tasks** to be undertaken in the financial analysis is as follows:

(1) Identifying the benefits and the costs of the project (investment and recurrent);

(2) Comparing the flows of benefits and costs and calculate the differences between the obtained results and the BAU (i.e. "without project") scenario in order to get the incremental net benefits of the project;

(3) Calculate the indicators of financial profitability of the project (financial net present value, financial rate of return and B/C ratio), applying the investment criteria to make the investment decision (positive or negative).

(4) Complement the above calculations with the "financial sustainability analysis"

**Financial sustainability is ensured if the** accumulated generated cash per each year **is positive or, at most, equal to zero for all the years considered**. On the contrary, if this figure is negative at any point in time, the project is **not sustainable** from the financial point of view, meaning that there are not enough financial resources to cover all cost required and it will be necessary to modify the financial structure or other components of the project.

34. The economic cost-benefit analysis builds on the financial analysis, with the addition of other impacts and benefits not directly captured by the latter

**Graph 2: From financial to Economic Analysis**

| | | YEARS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *Total operating revenues* | | 0 | 42 | 115 | 119 | 126 | 126 | 126 | 126 | 126 | 126 |
| **Total inflows** | | **0** | **42** | **115** | **119** | **126** | **126** | **126** | **126** | **126** | **126** |
| *Total operating costs* | | 0 | -56 | -75 | -98 | -101 | -101 | -101 | -101 | -117 | -117 |
| *Total investment costs* | | -165 | -4 | -4 | -24 | -3 | 0 | -26 | 0 | 0 | 12 |
| **Total outflows** | | **-165** | **-60** | **-79** | **-122** | **-104** | **-101** | **-127** | **-101** | **-117** | **-105** |
| Net cash flow | | -165 | -18 | 36 | -3 | 22 | 25 | -1 | 25 | 9 | 21 |
| **Financial rate of return on investment - FRR(C)** | | | | | | **-5.66%** | | | | | |
| **Financial net present value of the investment - FNPV(C)** | | | | | | **-74.04** | | | | | |

1. Conversion of market to accounting prices
2. Monetisation of non-market impacts
3. Inclusion of indirect effects (where relevant)
4. Discounting
5. Economic performance indicators

| | | YEARS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Fiscal correction*** | | | | | | | | | | | |
| *Decreased pollution elsewhere* | | 0 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| **External benefits** | | **0** | **11** | **11** | **11** | **11** | **11** | **11** | **11** | **11** | **11** |
| *Output X* | 1.2 | 0 | 32.4 | 72 | 76.8 | 76.8 | 76.8 | 76.8 | 76.8 | 76.8 | 76.8 |
| *Output Y* | 1.1 | 0 | 16.5 | 60.5 | 60.5 | 68.2 | 68.2 | 68.2 | 68.2 | 68.2 | 68.2 |
| **Total operating revenues** | | **0** | **48.9** | **132.5** | **137.3** | **145** | **145** | **145** | **145** | **145** | **145** |
| *Increased noise* | | 0 | -12 | -12 | -12 | -12 | -12 | -12 | -12 | -12 | -12 |
| **External costs** | | **0** | **-12** | **-12** | **-12** | **-12** | **-12** | **-12** | **-12** | **-12** | **-12** |
| *Labour* | 0.8 | 0 | -18.4 | -18.4 | -25.6 | -25.6 | -25.6 | -25.6 | -25.6 | -30.4 | -30.4 |
| *Other operating costs* | 1.1 | 0 | -36.3 | -57.2 | -72.6 | -75.9 | -75.9 | -75.9 | -75.9 | -86.9 | -86.9 |
| **Total operating costs** | | **0** | **-54.7** | **-75.6** | **-98.2** | **-101.5** | **-101.5** | **-101.5** | **-101.5** | **-117.3** | **-117.3** |
| **Total investment costs** | 0.9 | **-148.5** | **-3.6** | **-3.6** | **-21.6** | **-2.7** | **0** | **-23.4** | **0** | **0** | **10.8** |
| *Net cash flow* | | -148.5 | -10.4 | 52.3 | 16.5 | 39.8 | 42.5 | 19.1 | 42.5 | 26.7 | 37.5 |
| **Economic rate of return on investment - ERR** | | | | | | **11.74%** | | | | | |
| **Economic net present value of investment - ENPV** | | | | | | **53.36** | | | | | |
| **B/C ratio** | | | | | | **1.06** | | | | | |

** No fiscal correction is applied: it means no transfers, subsidies or indirect taxes have been included in the financial analysis in table 2.5.*

Source: Guide to cost benefit analysis of investment projects. European Union

35. **The economic analysis** looks at a project from the perspective of the entire country ("society") and measures the effects of the project on the economy as a whole. These different points of view will require for the analyst to take into consideration different items when looking at the costs of a project, valuate them differently and in some cases, even use different rates to discount the streams of costs and benefits.

36. EA-CBA is based on the essential theoretical foundations that benefits are defined as increases in human wellbeing (utility) and costs are defined as reductions in human wellbeing. For a project to be viable, its social benefits must exceed its social costs.

37. In the following example, the main tasks of an economic analysis are summarized. The results show that the project under analysis is not profitable from a financial point of view but it is feasible from an economic point of view.

**Box No 3: Steps to conduct an economic analysis**

CBA requires the assessment of a project's net impact on economic welfare. This is done in five steps:

(1) **externalities** are taken into account and given a monetary value;

(2) cancellation of **transfer payments** (taxes and subsidies);

(3) observed prices or public tariffs are converted into **shadow prices**, that better reflect the social opportunity cost of the good;

(4) costs and benefits are discounted with a **social rate of discount**;

(5) economic performance indicators are calculated: economic net present value (ENPV), economic rate of return (ERR) and the benefit-cost (B/C) ratio.

Critical parameters are: (i) the shadow prices for tradable and non tradable goods; (ii) the shadow price for the rate of foreign exchange; (iii) the shadow price for labour costs (shadow wage); and, the social rate of discount.

In addition, every CBA should be complemented with a complete Sensitivity Analysis in order to deal with the main risks and uncertainties that might affect the proposed project.

Source: Guide to cost benefit analysis of investment projects. European Union

38. **A full description of each step with examples is presented in Section IV of this IG.** Detailed explanation and guidelines for the calculation of shadow prices are also included in Section IV focused on the "typical" IFAD production-oriented project.

## *III The EFA for IFAD rural investment projects.*

39. ***IFAD rural investment projects include a broad variety of activities***. Among others, there are: integrated rural development projects, irrigation projects, rural credit and extension projects, value-chain development projects, rural financial services projects, natural resources management projects, community development projects, institutional strengthening projects, etc. This typology is also valid for almost all IFIs.

40. What is the main difference between IFAD and other IFIs financing agricultural development? While other IFIs can finance agricultural investment projects directed to and/or carried out by large agricultural firms and large and medium-size farmers, **IFAD must follow its main mandate of focusing its projects in benefiting the rural poor**[20].

[20] 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

41. Therefore, IFAD projects are characterized and designed on the basis of the identification of a target-group composed of rural poor. Rural poor include different productive and economic categories: the main one being the smallholders sector, others consider the landless population engaged in rural non-agricultural micro-entrepreneurs, rural workers, fishermen, etc. and lastly special vulnerable groups such as women, indigenous minorities, youth, etc. All IFAD projects must be formulated on the basis of benefiting one or more of the above-mentioned rural poor groups.

42. This IFAD "specificity" has direct consequences on the CBA discussion of the "standing issue" [21]. In general, investment projects include a number of social stakeholders and these situations have also implications for the valuation of the benefits and costs accrued for different "socio-economic groups" and the distributional effects involved. *For IFAD rural investment projects*, in general, this is not a major issue since the formulation of IFAD projects is focused on benefiting a specific target group: i.e. the rural poor [22]

### *Focusing on IFAD "typical" rural investment projects and its main benefits*

43. The "typical" IFAD project is usually a "production-oriented project" [23] and its main benefits (i.e. financial and economic ones) are usually net production increases. In other words, **most of IFAD projects will have a direct impact on the production conditions of the beneficiaries which, in turn, lead to net income increases.**

44. In general, IFAD typical projects enhance the rural poor access to services and inputs that would increase their production volumes and/or productivity: i.e. improved technological packages for crops and livestock through extension services; rural finance tools to support on-farm investments and increased access to working capital through grants and/or credit/loan schemes, or others[24].; water supply for irrigation through the construction of irrigation schemes and facilities; improved post-harvest conditions through the provision of storage and cooling facilities, technical advisory and financial resources to establishing and/or developing rural non-agricultural micro-enterprises, etc. as well as a set of combinations of the above-mentioned inputs.

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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."

[21] In the CBA-EFA literature, the question of 'whose costs and benefits count?' is known as the 'standing' issue. (i.e. whose welfare counts in the aggregation of net benefits).

[22] There might be exceptional situations in which other social groups could benefit from an IFAD project. These cases might require additional analyses (i.e. distributional effects analysis) when undertaking the EFA.

[23] Out of 114 projects reviewed by QE between 2009 and 2011, 73% are agricultural or rural development-related while 16% core objective was to strengthening financial services and the rest had a specific focus on capacity building and natural resources management. These data shows that most IFAD's projects can be characterised as "production-oriented projects", designed to have direct impacts on production and productivity increase.

[24] Inclusive innovative/adapted rural finance products and services, including risk management strategies, savings, financial literacy/education programs, etc.

45. This fact leads to some straight forward requirements for the analysis of financial and economic results of IFAD production-oriented projects: *Firstly,* **the project should be assessed in terms of the financial profitability and sustainability of the productive activities of the targeted beneficiaries**; *secondly*: **the project should be assessed in terms of its economic viability for the whole national economy.**

46. Therefore, in IFAD production-oriented projects, the main goal of the **financial analysis** is to determine whether the farmers or other stakeholders will have enough incentives to participate in the project.

47. In other words, the financial analysis needs to determine if the farmers will obtain a net incremental benefit ("financial profitability analysis") as well as assessing whether they'll have for example, enough working capital to buy the additional farm inputs or to assume the costs of stocking processed goods ("financial sustainability").

48. In general, IFAD production-oriented projects include several types of production activities (i.e. different "farm-models" and different "activity-models") and different numbers of beneficiaries per each type of production. All these need to be analysed from a financial perspective. It is also useful to undertake the Financial Analysis of the project "as a whole"[25].

49. The analysis of this situation requires the solution of an "aggregation issue" (i.e. the aggregation of the financial results of the single farm and activity models) that would summarise the results of the project[26].

50. On the basis of the results of the financial analysis, **the economic analysis** focus on the perspective of the entire country, or society, and measures the effects of the project on the economy as a whole.

### *Other types of projects (and/or project components) and their benefits*

51. All the same, there are IFAD projects (and /or project components) that are not directly related with the improvement of production and productivity conditions of the beneficiaries.

[25] It can be argued that this stage of the analysis might be useless since the financial profitability indicators for the project as a whole have no use in terms of investment decisions. This IG recommends, however, to undertake this stage of the analysis due to the fact that: (a) the economic analysis is going to be undertaken using the basic data and tables of the financial analysis of the Project as a whole and, therefore, these calculations are useful in practical terms; (b) the comparison between the financial profitability indicators with those obtained with the economic analysis might be very meaningful since the gap between both is an indicator of the degree of market distortions that affect the economy under analysis. See Section IV for more details.

[26] See Section IV for more details on this subject.

52. The most typical examples are: rural roads, natural resources conservation, community development, institutional strengthening, etc. while in some cases there are components related only to the improvement of social conditions such as drinking water facilities, latrines and others.

53. The review of the EFA of these projects shows that usually the economic benefits related to these components have neither been identified nor valued.

54. The identification and valuation of benefits for this type of investments is usually more difficult than the case of productive activities. Nevertheless, there are several available methods to carry out this type of analysis and it is expected that they would be progressively adopted by IFAD project formulators and included in the analysis. [27]

55. As an overview of possible examples, see below a table summarizing quantifiable benefits from specific project's components:

[27] See Section V of this guideline for a more accurate analysis and specific examples. In future versions of this IG more detailed information and examples would be provided..

| Project components | Quantifiable benefits |
|---|---|
| **Rural infrastructure**: Storage facilities, Irrigation, | ➢ Post-harvest losses reduction<br>➢ Increased value of the final product due to investments in storage and cooling facilities, or small scaling processing (like drying or conserving)<br>➢ Increases in product and productivity thanks to water provision |
| **Value chain**: collective marketing; warehouse receipt systems; increased market information | ➢ Increased value of the final product thanks to increased access to markets<br>➢ Creation of internal and external markets that did not exist before investments<br>➢ Distribution of value added among the main actors of the VC |
| **Rural Roads**: | ➢ Reduction in transportation costs and in vehicle maintenance costs (VOC-TTC)<br>➢ Increased volume of transported agricultural products for sale<br>➢ Post-harvest losses reduction due to better access to sale points |
| **Domestic Water Supply** | ➢ Time saved from not having to carry water from the original source<br>➢ Reduction in sickness through consumption of better water quality<br>➢ Reduced water losses due to leakages<br>➢ Increased productivity through small plots crop irrigation and through the provision of water for livestock<br>➢ Backyard gardening |
| **Rural finance** | ➢ Efficiency gains in the financial system can lower operation costs and ensure self-sufficiency and sustainability of financial services supply.<br>➢ Shifts in the portfolio composition of the FIs (productive loans versus consumption)<br>➢ Incremental taxation revenues to the government<br>➢ Potential productivity increases through financing of the working capital. (incremental benefits to the clients/borrowers)<br>➢ Economic benefits from transfer effects |
| **NRM practices** (changes in tillage practices, crop rotations, land/soil conversion, afforestation, energy efficient systems, 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<br>➢ Increasing crop, timber and livestock yields through soil preservation, conservation tillage and agriculture<br>➢ Increased final product value thanks to labelling as Organic Agricultural practices<br>➢ Avoiding rehabilitation costs of public infrastructure destroyed by natural disasters<br>➢ Energy saving thanks to replacement of old practices by eco-friendly artefacts (eco-stoves, solar panels, etc…). |
| **Land registration** | Land tenure security may translate into an increased land value explained by:<br>➢ Long term Investments for land fertility<br>➢ Improve access to credit as land can be used as a collateral guarantee for credit<br>➢ Greater dynamism of land markets.<br>➢ Environmental benefits as a result of better NRM (people improve or maintain forest and/or tree cover) |
| All projects have the additional benefit of employment generation (farm and off-farm) | |
| All project generate a multiplier effect on the economy as a whole as rural poor increases their income or access to credit, allowing for incremental consumption. | |

### *Use of EFA as a tool in project design and implementation*

56. For the reasons stated in the "relevance" and other previous sections, EFA can and should play a key role in project design and implementation, mostly when referring to:

(I) use of economic and financial analysis (EFA) in project design,

(II) use of EFA in project supervision and implementation

#### *Use of economic and financial analysis (EFA) in project design*

57. The logframe provides a structure which can be useful to organize the data and assumptions utilized in EFA's elaboration. Key data relevant for the estimation of costs and benefits, and assumptions made concerning incremental yields; adoption rates; etc. should be incorporated into the logframe.

58. One of the important sources of data for EFA is IFAD's evaluation of completed operations. These evaluations can provide reference values for similar projects or projects in the same country (and region), for example on uptake (adoption rates) of a specific technology or constraints in input availability. IFAD evaluations for country/region are available at

http://www.ifad.org/evaluation/public_html/eksyst/doc/prj/index.htm

59. Furthermore, economic and financial analysis included in appraisal reports for the same country &/or region &/or sector, from IFAD and other IFIs, like the World Bank or regional development banks, are potential sources of information on key parameters such as discount rates.

60. EFA can be used during project design in the process of selecting project components. On the basis of their single economic viability, project components or subcomponents, could be compared and decisions on whether to drop them or not could be taken if necessary. In addition, EFA can also be used in the design stage to ensure that the logframe includes appropriate and coherent indicators. If the logframe is prepared early in the design process, as it should, then the logframe can be used for guiding the EFA, as indicated in the first paragraph of this subsection. Finally, during the design process EFA can also be used to identify key risks and to suggest risk mitigation measures.

61. Thus, the sensitivity analysis (SA) may show that the project rate of return is particularly sensitive to different types of risks, affecting benefits, costs and/or the timing of project benefits. If so, mitigation measures should be considered for the different types of risks that SA identifies as high risks. The following matrix can be useful for analysing the SA results, linking them to the types of risks and to the high or low sensitivity of the project to each "critical variable"[28].

[28] For more precise definition and use of sensitivity analysis see Section IV of this IG sub-section Risk and Sensitivity Analysis

**Risk Analysis Matrix linked with Sensitivity Analysis**

| | Risk description | Probability of occurrence | Mitigation measure | Proxy to be compared with SA results: (i) increment in Costs; (ii) Decreases in benefits or (iii) Delay in Benefits |
|---|---|---|---|---|
| Institutional risks | | | | |
| Market risks | | | | |
| Policy risks | | | | |
| Other risks | | | | |

62. The cells should indicate whether the analysed risk leads to a high (or highly significant) or low delay in benefits and/or increments in costs. In the former case, when the SA shows that there is high sensitivity of benefits and/or costs to a specific type of risk, a risk mitigation measure should be identified. The following examples indicate how to proceed in high risk cases:

i) *Institutional risks* leading to significant lags in the generation of project benefits. This may be due to institutional weaknesses causing implementation delays. A mitigation measure could be the provision of technical support/assistance during project implementation, and to assume a slow build up in benefits

ii) *Market risks* causing a significant decrease of benefits due to lower market prices caused by a market glut (oversupply) in the regional market; a mitigation measure could be a more diversified production pattern and/or provision of information on alternative markets

iii) *Policy risks* generating highly increased project costs due to tariffs or duties imposed on project's inputs. In this case, a mitigation measure could be the negotiation of tariffs or duties exemptions.

### *Use of EFA in project supervision and implementation*

63. The data used for EFA in project design should be periodically updated by the project's M&E system whereas supervision/implementation support missions should verify that this updating has taken place.

64. If significant changes took place in the data, particularly those for which the sensitivity analysis showed higher sensitivity, the internal rate of return, net present value and cost-benefit ratio should be recalculated.

65. In light of new data (for example, concerning prices, and/or forecasted prices, for inputs and outputs relevant for the project; demand forecast for project's outputs and/or adoption rates), and taking into account the results of the updated EFA, including the identified risks and

the suggested mitigation measures, it may become appropriate during project supervision and/or implementation support to make decisions concerning the reallocation of resources among activities and/or components, shifting from those that, at the new constellation of data, contribute less, to those that would contribute more, to the project's objectives.

66. **The cost benefit analysis spreadsheet prepared during project appraisal should remain available for review during project implementation and evaluation** (this recommendation, included in the World Bank's evaluation of cost/benefit analysis in World Bank projects[29], would facilitate the updating process indicated in the preceding paragraph and would also enable an appropriate comparison of ex-ante with ex-post economic rates of returns)

67. Finally, it is important to distinguish in the logframe the output from the outcome indicators[30]. During the initial years of the project, its supervision should focus on the output indicators. As project implementation proceeds, the focus should shift to (or at least include) outcome indicators, which provide key data for performing EFA.

## Summing-up

68. EFA can and should play a key role in project design, supervision and implementation support. The purpose of EFA in each of these phases of the project cycle, including evaluation, is indicated in the following table:

**Purpose of EFA corresponding to phases of the project cycle**

| **Project Cycle Phase** | **Design** | **Supervision/Implementation support** | **Evaluation** |
|---|---|---|---|
| **Purpose of EFA** | Resource allocation decisions | Resource **re**allocation decisions | Assessment of results |

[29] Independent Evaluation Group (2010) "Cost-Benefit Analysis in World Bank Projects" Washington DC: The World Bank , pp.47 & .49

[30] A good practice example of a logframe distinguishing between output and outcome indicators is the **Cambodia**: Project for Agricultural Development and Economic Empowerment, **EB 2012/105/R.15/Rev.1** ,http://www.ifad.org/gbdocs/eb/105/e/index.htm. It should be noted that Annual Reports on Quality Assurance in IFAD's Projects and Programmes (e.g. Document: EB 2009/98/R.57) have called attention to the imprecise development objectives and lack of quantified final and intermediate outcome indicators to track progress towards achieving the objectives. This deficiency also affects the quality of EFA and the possibility of using EFA during project supervision and implementation support. Therefore, the improvement of the quality of logframe can contribute to improving the quality of EFA and to enhance its use during project supervision and implementation support.

## *IV Minimum requirements for EFA in IFAD*

69. This Section is focused on the EFA of "typical" IFAD rural investment projects. It has the purpose of guiding step by step the work of project analysts (economist, consultants, etc..) providing examples and trying to reply to the most common queries during the undertaking of the EFA of IFAD production-oriented projects.

### *Step by step: The process of EFA*

70. The above presented considerations lead to the following sequence of methodological steps for undertaking the typical EFA of IFAD rural investment production-oriented projects:

### *Financial analysis:*

71. This **first step** focuses on the **productive-units** of the target-groups (i.e. the potential beneficiaries of the project)[31]. The financial analysis is the starting point for the subsequent economic analysis. It provides all the necessary data regarding input, output, their relative prices and how they are distributed over time. **All costs and benefits should be valued at "market prices".** The focus during the next three steps will be on the financial performance of the beneficiaries' productive-units, while the last one will focus on the financial analysis of the Project "as a whole".

**Box No 4: The example. A Project in *Guideland*: Brief description.**

The proposed Project is located in a hilly area in the country of *Guideland*. Agro-ecological conditions are tropical and humid.

Rural income poverty line in the region is estimated at $ 8 500 per rural household. $ being the national currency of *Guideland*.

There are approximately 2 000 small holdings (average area of 10 ha) in the project area. All of them are poor. Typical crops are cassava, maize, banana and coffee. Most farmers cultivate the four crops in their holdings: maize and cassava mainly for self-consumption and banana and coffee for selling to the market ("cash crops").

Agronomists consider that with better technologies to be transferred to the farmers through adequate extension services the farmers would increase their production and productivity leading to higher family incomes. Therefore, the **preliminary** Project components consist of: (a) Extension services; and (b) Project management Unit. Total Project cost, under this alternative, is estimated at $ 6.3 million. The country has no inflation. The passive rate of interest is 7%. There are restrictions in foreign trade (import duties and export taxes). Unemployment rate in rural areas is about 30%. Indirect taxes (VAT) apply to all tradable goods (i.e. 10%). The Official Rate of Exchange is USD 1=$ 1.15.

[31] As clearly expressed in the IFAD Learning Notes (KSF 3 -3.6-), information is needed to assess "the attractiveness of the investment (and project interventions) to the target group. Return to capital calculations can be supplemented with returns to labour and land".

***A.*** *Clear and sufficient information on the expected financial costs and benefits for the "target group" should be provided. This information should include the description of the "without project" and "with project" situations for the different types of beneficiaries in order to clearly understand the expected improvements due to the project proposals.*

72. The recommended tool for the description of the beneficiaries' "without project" production conditions situation is the formulation and presentation of "**farm models**" 'which are developed based on information provided by the "crop models" and "activity models"[32] for the different types of beneficiaries.[33]

73. The **crop models** as well as the farm models are composed by two important parts: (a) the technical and physical description of the production situation, and (b) the financial results of the production conditions (i.e. farm budget). The former is important to justify the main constraints for production development and the latter is important to assess the poverty situation.

74. It is very important to avoid the confusion between "present situation" and "without project situation". The "**without project**" situation is a forecast of the present situation which could include different future trajectories: (a) a gradual improvement of present conditions due to expected positive elements (e.g. prices positive evolution; gradual adoption of better technologies, etc.); (b) the maintenance of present productive conditions in the future; and, (c) the worsening of present productive conditions due to expected negative elements (e.g. gradual loss of soil fertility and yields; price decreases for present crop varieties, etc.).

75. The "**with project**" situation is also properly described with the same type of analytical tools. The clear presentation of this information is basic to understand the "expected benefits" of the new technology proposed by the project.

76. The following are examples of "crop-models" for four crops (maize, cassava , banana and coffee) :

[32] Crop models and activity models (used for livestock and/or other production activities) are usually prepared technically for 1 unit of area (i.e. ha, acres, etc.). Generally, the national agricultural research institutions have this type of analytical tools. 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 agri-ecological and productive situations.

[33] As a matter of fact, the optimal tool should be "rural household models" where, in addition to data related to the productive conditions, other items should be included such as off-farm incomes, women-incomes, etc.

## Table 1: Maize Crop Model

Guideland
Rural Development Project
Maize Crop Model

| YIELDS AND INPUTS (Per ha) | Unit | Existing Technology | New Technology | | |
|---|---|---|---|---|---|
| | | 1 to 20 | 1 | 2 | 3 to 20 |
| Yields | kg | 1,700 | 1,800 | 1,900 | 2,000 |
| **Operating** | | | | | |
| **Inputs** | | | | | |
| Maize seed | plant | 35 | 35 | 35 | 35 |
| Fertilizer | kg | - | 75 | 75 | 75 |
| Chemicals | kg | - | 1 | 1 | 1 |
| Sacks | sack | 8 | 10 | 10 | 10 |
| **Labor** | | | | | |
| Unskilled labor | manday | 41 | 45 | 45 | 45 |

## Table 2: Maize Crop Budget

Guideland
Rural Development Project
Maize Crop Model

| FINANCIAL BUDGET (In $ Per ha) | Existing Technology | New Technology | | | Increments | | |
|---|---|---|---|---|---|---|---|
| | | | | | Crop year | | |
| | 1 to 20 | 1 | 2 | 3 to 20 | 1 | 2 | 3 to 20 |
| Revenue | 382.5 | 405.0 | 427.5 | 450.0 | 22.5 | 45.0 | 67.5 |
| **Input costs** | | | | | | | |
| Maize seed | 13.1 | 13.1 | 13.1 | 13.1 | - | - | - |
| Fertilizer | - | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| Chemicals | - | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Sacks | 3.2 | 4.0 | 4.0 | 4.0 | 0.8 | 0.8 | 0.8 |
| **Sub-total Input costs** | 16.3 | 38.6 | 38.6 | 38.6 | 22.3 | 22.3 | 22.3 |
| **Income (Before Labor Costs)** | 366.2 | 366.4 | 388.9 | 411.4 | 0.2 | 22.7 | 45.2 |
| **Labor costs** | | | | | | | |
| Unskilled labor | 82.0 | 90.0 | 90.0 | 90.0 | 8.0 | 8.0 | 8.0 |
| **Income (After Labor Costs)** | 284.2 | 276.4 | 298.9 | 321.4 | -7.8 | 14.7 | 37.2 |

## Table 3: Cassava Crop Model

Guideland
Rural Development Project
Cassava crop model

| YIELDS AND INPUTS (Per ha) | Unit | Existing Technology | New Technology | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 to 20 | 1 | 2 | 3 | 4 | 5 to 20 |
| Yields | kg | 7,000 | 7,000 | 7,500 | 8,000 | 8,500 | 9,000 |
| **Operating** | | | | | | | |
| **Inputs** | | | | | | | |
| Yuca cuttings | plant | 8 | 8 | 10 | 10 | 10 | 10 |
| Chemicals | kg | - | 1 | 1 | 1 | 1 | 1 |
| **Labor** | | | | | | | |
| Unskilled labor | manday | 72 | 78 | 78 | 78 | 78 | 78 |

## Table 4: Cassava Crop Budget

Guideland
Rural Development Project
Cassava crop model
**FINANCIAL BUDGET**
(In $ Per ha)

| | Existing Technology | New Technology | | | | | Increments | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Crop year | | | | | | | | | | |
| | 1 to 20 | 1 | 2 | 3 | 4 | 5 to 20 | 1 | 2 | 3 | 4 | 5 to 20 |
| Revenue | 840.0 | 840.0 | 900.0 | 960.0 | 1,020.0 | 1,080.0 | - | 60.0 | 120.0 | 180.0 | 240.0 |
| **Input costs** | | | | | | | | | | | |
| Yuca cuttings | 7.6 | 7.6 | 9.5 | 9.5 | 9.5 | 9.5 | - | 1.9 | 1.9 | 1.9 | 1.9 |
| Chemicals | - | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| **Sub-total Input costs** | 7.6 | 12.6 | 14.5 | 14.5 | 14.5 | 14.5 | 5.0 | 6.9 | 6.9 | 6.9 | 6.9 |
| **Income (Before Labor Costs)** | 832.4 | 827.4 | 885.5 | 945.5 | 1,005.5 | 1,065.5 | -5.0 | 53.1 | 113.1 | 173.1 | 233.1 |
| **Labor costs** | | | | | | | | | | | |
| Unskilled labor | 144.0 | 156.0 | 156.0 | 156.0 | 156.0 | 156.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| **Income (After Labor Costs)** | 688.4 | 671.4 | 729.5 | 789.5 | 849.5 | 909.5 | -17.0 | 41.1 | 101.1 | 161.1 | 221.1 |

## Table 5: Banana Crop Model

Guideland
Rural Development Project
Banana Crop Model
**YIELDS AND INPUTS**
(Per ha)

| | | Existing Technology | New Technology | | | | | Increments | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Crop year | | | | | | | | | | |
| | Unit | 1 to 20 | 1 | 2 | 3 | 4 | 5 to 20 | 1 | 2 | 3 | 4 | 5 to 20 |
| Yields | kg | 6,000 | - | 6,500 | 7,000 | 7,500 | 8,000 | -6,000 | 500 | 1,000 | 1,500 | 2,000 |
| **Investment** | | | | | | | | | | | | |
| **Inputs** | | | | | | | | | | | | |
| Banana suckers | plant | - | 700 | - | - | - | - | 700 | - | - | - | - |
| Fertilizer | kg | - | 25 | - | - | - | - | 25 | - | - | - | - |
| Chemicals | kg | - | 1 | - | - | - | - | 1 | - | - | - | - |
| **Labor** | | | | | | | | | | | | |
| Unskilled labor | manday | - | 10 | - | - | - | - | 10 | - | - | - | - |
| **Operating** | | | | | | | | | | | | |
| **Inputs** | | | | | | | | | | | | |
| Banana suckers | plant | 70 | - | 150 | 150 | 150 | 150 | -70 | 80 | 80 | 80 | 80 |
| Fertilizer | kg | - | - | 50 | 50 | 50 | 50 | - | 50 | 50 | 50 | 50 |
| Chemicals | kg | - | - | 2 | 2 | 2 | 2 | - | 2 | 2 | 2 | 2 |
| **Labor** | | | | | | | | | | | | |
| Unskilled labor | manday | 40 | - | 60 | 60 | 60 | 60 | -40 | 20 | 20 | 20 | 20 |

## Table 6: Banana Crop Budget

Guideland
Rural Development Project
Banana Crop Model

| FINANCIAL BUDGET (In $ Per ha) | Crop year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing Technology | New Technology | | | | | Increments | | | | |
| | 1 to 20 | 1 | 2 | 3 | 4 | 5 to 20 | 1 | 2 | 3 | 4 | 5 to 20 |
| Revenue | 1,800.0 | - | 1,950.0 | 2,100.0 | 2,250.0 | 2,400.0 | -1,800.0 | 150.0 | 300.0 | 450.0 | 600.0 |
| **Input costs** | | | | | | | | | | | |
| **Investment costs** | | | | | | | | | | | |
| Banana suckers | - | 21.0 | - | - | - | - | 21.0 | - | - | - | - |
| Fertilizer | - | 5.5 | - | - | - | - | 5.5 | - | - | - | - |
| Chemicals | - | 5.0 | - | - | - | - | 5.0 | - | - | - | - |
| **Sub-total Investment Costs** | - | 31.5 | - | - | - | - | 31.5 | - | - | - | - |
| **Operating Costs** | | | | | | | | | | | |
| Banana suckers | 2.1 | - | 4.5 | 4.5 | 4.5 | 4.5 | -2.1 | 2.4 | 2.4 | 2.4 | 2.4 |
| Fertilizer | - | - | 11.0 | 11.0 | 11.0 | 11.0 | - | 11.0 | 11.0 | 11.0 | 11.0 |
| Chemicals | - | - | 10.0 | 10.0 | 10.0 | 10.0 | - | 10.0 | 10.0 | 10.0 | 10.0 |
| **Sub-total Operating Costs** | 2.1 | - | 25.5 | 25.5 | 25.5 | 25.5 | -2.1 | 23.4 | 23.4 | 23.4 | 23.4 |
| **Sub-total Input costs** | 2.1 | 31.5 | 25.5 | 25.5 | 25.5 | 25.5 | 29.4 | 23.4 | 23.4 | 23.4 | 23.4 |
| **Income (Before Labor Costs)** | 1,797.9 | -31.5 | 1,924.5 | 2,074.5 | 2,224.5 | 2,374.5 | -1,829.4 | 126.6 | 276.6 | 426.6 | 576.6 |
| **Labor costs** | | | | | | | | | | | |
| **Investment costs** | | | | | | | | | | | |
| Unskilled labor | - | 20.0 | - | - | - | - | 20.0 | - | - | - | - |
| **Operating Costs** | | | | | | | | | | | |
| Unskilled labor | 80.0 | - | 120.0 | 120.0 | 120.0 | 120.0 | -80.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| **Sub-total Labor costs** | 80.0 | 20.0 | 120.0 | 120.0 | 120.0 | 120.0 | -60.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| **Income (After Labor Costs)** | 1,717.9 | -51.5 | 1,804.5 | 1,954.5 | 2,104.5 | 2,254.5 | -1,769.4 | 86.6 | 236.6 | 386.6 | 536.6 |

## Table 7: Coffee Crop Model

Guideland
Rural Development Project
Coffee Crop Model

| **YIELDS AND INPUTS** (Per ha) | Unit | Existing Technology | New Technology | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **1 to 20** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9 to 20** |
| Yields | kg | 400 | - | - | - | 450 | 500 | 550 | 600 | 650 | 700 |
| **Investment** | | | | | | | | | | | |
| **Inputs** | | | | | | | | | | | |
| Coffee seeding | plant | - | 1,750 | 200 | 200 | - | - | - | - | - | - |
| Fertilizer | kg | - | 200 | 200 | 200 | - | - | - | - | - | - |
| Land preparation | unit | - | 1 | - | - | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | |
| Lining and holing | manday | - | 20 | 2 | 2 | - | - | - | - | - | - |
| Transport | manday | - | 15 | 2 | 2 | - | - | - | - | - | - |
| Pruning | manday | - | 10 | 10 | 2 | - | - | - | - | - | - |
| Fertilization | manday | - | 2 | 2 | 2 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | |
| **Inputs** | | | | | | | | | | | |
| Fertilizer | kg | - | 50 | 75 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Chemicals | kg | 1 | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 |
| **Labor** | | | | | | | | | | | |
| Weeding | manday | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| Chemical application | manday | 2 | - | - | - | 4 | 4 | 4 | 4 | 4 | 4 |
| Fertilizer application | manday | - | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Pruning | manday | - | - | - | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Harvest | manday | 18 | - | - | - | 28 | 28 | 28 | 28 | 28 | 28 |
| Processing | manday | 3 | - | - | - | 3 | 3 | 3 | 3 | 3 | 3 |
| Transport | manday | 2 | - | - | - | 3 | 3 | 3 | 3 | 3 | 3 |

## Table 8: Coffee Crop Budget

Guideland
Rural Development Project
Coffee Crop Model

| **FINANCIAL BUDGET** (In $ Per ha) | **Existing Technology** | **New Technology** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1 to 20** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9 to 20** |
| Revenue | 756.0 | - | - | - | 850.5 | 945.0 | 1,039.5 | 1,134.0 | 1,228.5 | 1,323.0 |
| **Input costs** | | | | | | | | | | |
| **Investment costs** | | | | | | | | | | |
| Coffee seeding | - | 350.0 | 40.0 | 40.0 | - | - | - | - | - | - |
| Fertilizer | - | 44.0 | 44.0 | 44.0 | - | - | - | - | - | - |
| Land preparation | - | 90.0 | - | - | - | - | - | - | - | - |
| **Sub-total Investment Costs** | - | 484.0 | 84.0 | 84.0 | - | - | - | - | - | - |
| **Operating Costs** | | | | | | | | | | |
| Fertilizer | - | 11.0 | 16.5 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 |
| Chemicals | 5.0 | - | - | - | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 |
| **Sub-total Operating Costs** | 5.0 | 11.0 | 16.5 | 22.0 | 47.0 | 47.0 | 47.0 | 47.0 | 47.0 | 47.0 |
| **Sub-total Input costs** | 5.0 | 495.0 | 100.5 | 106.0 | 47.0 | 47.0 | 47.0 | 47.0 | 47.0 | 47.0 |
| **Income (Before Labor Costs)** | 751.0 | -495.0 | -100.5 | -106.0 | 803.5 | 898.0 | 992.5 | 1,087.0 | 1,181.5 | 1,276.0 |
| **Labor costs** | | | | | | | | | | |
| **Investment costs** | | | | | | | | | | |
| Lining and holing | - | 40.0 | 4.0 | 4.0 | - | - | - | - | - | - |
| Transport | - | 30.0 | 4.0 | 4.0 | - | - | - | - | - | - |
| Pruning | - | 20.0 | 20.0 | 4.0 | - | - | - | - | - | - |
| Fertilization | - | 4.0 | 4.0 | 4.0 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | - | 94.0 | 32.0 | 16.0 | - | - | - | - | - | - |
| **Operating Costs** | | | | | | | | | | |
| Weeding | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 | 72.0 |
| Chemical application | 4.0 | - | - | - | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Fertilizer application | - | 2.0 | 2.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Pruning | - | - | - | 2.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Harvest | 36.0 | - | - | - | 56.0 | 56.0 | 56.0 | 56.0 | 56.0 | 56.0 |
| Processing | 6.0 | - | - | - | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Transport | 4.0 | - | - | - | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| **Sub-total Operating Costs** | 122.0 | 74.0 | 74.0 | 78.0 | 156.0 | 156.0 | 156.0 | 156.0 | 156.0 | 156.0 |
| **Sub-total Labor costs** | 122.0 | 168.0 | 106.0 | 94.0 | 156.0 | 156.0 | 156.0 | 156.0 | 156.0 | 156.0 |
| **Income (After Labor Costs)** | 629.0 | -663.0 | -206.5 | -200.0 | 647.5 | 742.0 | 836.5 | 931.0 | 1,025.5 | 1,120.0 |

77. Notice that in the "without project" situation, for these crop models, it was assumed that present productive conditions would be maintained in the future.

78. On the basis of this technical and financial information, the analyst should review the agrarian structure in the project area, identify the different sizes of farms and the use of land in the different types of farms, in order to prepare "representative farm-models" that would illustrate the present and the "without project situation".

79. Subsequently, the agronomist and other experts would formulate the technical proposal in order to improve the production conditions and productivity of the different farms.

80. In the following tables, examples are provided for only one farm-model (the "coffee model") that includes the production of four crops: maize, cassava, banana and coffee. The typical farm-model is a farm with 10 ha of cultivable land. Approximately 2 000 potential beneficiaries of the project work in holdings with these characteristics.[34]

81. Therefore, the first step consists in the description of the cropping patterns and land use in the without and with project situation, as follows:

**Table 9: Cropping patterns**

Guideland
Rural Development Project
Coffee Farm Model
**CROPPING PATTERNS**
(In Units)

| | Unit | Without Project | With Project | | | |
|---|---|---|---|---|---|---|
| | | 1 to 20 | 1 | 2 | 3 | 4 to 20 |
| Cropping Intensity | Percent | 75 | 80 | 85 | 85 | 85 |
| **Cropping Pattern** | | | | | | |
| **Existing Technology** | | | | | | |
| Cassava | ha | 0.5 | - | - | - | - |
| Maize | ha | 0.5 | - | - | - | - |
| Banana | ha | 1.5 | 1.5 | 1 | - | - |
| Coffee | ha | 5 | 5 | 4 | 3 | 1 |
| **Sub-total Existing Technology** | | 7.5 | 6.5 | 5 | 3 | 1 |
| **New Technology** | | | | | | |
| Cassava | ha | - | 0.5 | 0.5 | 0.5 | 0.5 |
| Maize | ha | - | 0.5 | 1 | 1 | 1 |
| Banana | ha | - | 0.5 | 1 | 2 | 2 |
| Coffee | ha | - | - | 1 | 2 | 4 |
| **Sub-total New Technology** | | - | 1.5 | 3.5 | 5.5 | 7.5 |
| **Total Cropped Area** | | 7.5 | 8 | 8.5 | 8.5 | 8.5 |

[34] 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 cover 136 000 beneficiaries; in Mexico, the Territory Development Project in the Mixteca Region, approved in 2 011, 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 adopt to undertake EFA.

82. In table 9 the area under cultivation in the "WOP situation" has been assumed to be 7.5 ha which leave 2.5 ha without cropping. The "WP situation" is proposing to increase the cropping intensity and cultivate 8.5 ha. The area dedicated to maize and banana would increase. The area dedicated to cassava and coffee would be the same as in the "WP situation". This technical proposal implies the introduction of better technologies and the consequent increases in productivity for all crops. Table 10 shows these expected results

**Table 10: WOP/WP situation: New production yields and input requirements**

| Guideland<br>Rural Development Project<br>Coffee Farm Model<br>**PRODUCTION AND INPUTS (Deta**<br>(In Units) | Unit | Without Project | With Project | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 to 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 to 20 |
| **Main Production** | | | | | | | | | |
| Cassava | kg | 3,500 | 3,500 | 3,750 | 4,000 | 4,250 | 4,500 | 4,500 | 4,500 |
| Banana | kg | 9,000 | 9,000 | 9,250 | 6,750 | 13,750 | 14,750 | 15,500 | 16,000 |
| Maize | kg | 850 | 900 | 1,900 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Coffee | kg | 2,000 | 2,000 | 1,600 | 1,200 | 400 | 850 | 1,350 | 2,350 |
| **Investment** | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | |
| Banana suckers | plant | - | 350 | 350 | 700 | - | - | - | - |
| Coffee seeding | plant | - | - | 1,750 | 1,950 | 3,900 | 600 | 400 | - |
| Fertilizer | kg | - | 12.5 | 212.5 | 425 | 800 | 600 | 400 | - |
| Chemicals | kg | - | 0.5 | 0.5 | 1 | - | - | - | - |
| Land preparation | unit | - | - | 1 | 1 | 2 | - | - | - |
| Equipment | amount | - | - | 1,056 | 935 | 595 | - | - | - |
| **Labor** | | | | | | | | | |
| Unskilled labor | manday | - | 5 | 52 | 73 | 118 | 40 | 16 | - |
| **Operating** | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | |
| Maize seed | plant | 17.5 | 17.5 | 35 | 35 | 35 | 35 | 35 | 35 |
| Cassava cuttings | plant | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| Banana suckers | plant | 105 | 105 | 145 | 150 | 300 | 300 | 300 | 300 |
| Fertilizer | kg | - | 37.5 | 150 | 250 | 450 | 525 | 575 | 575 |
| Chemicals | kg | 5 | 6 | 6.5 | 6.5 | 6.5 | 11.5 | 16.5 | 26.5 |
| Sacks | sack | 4 | 5 | 10 | 10 | 10 | 10 | 10 | 10 |
| **Labor** | | | | | | | | | |
| Unskilled labor | manday | 421.5 | 426.5 | 435 | 401 | 415 | 456 | 499 | 577 |

83. In table 10 it is possible to appreciate the increments in the quantities of purchased inputs (mainly, fertilizers and chemicals) respect to the "without project situation" as well as the requirements of investments due to the new plantations of banana and coffee. Similarly, it is also possible to appreciate the increases in the volume of production of the different crops and the decrease in the production of banana (year 3) and coffee (from year 2 to 5) due to the to the proposal of eradicate old banana and coffee plants with low productivity and replace them with better and new varieties. The labour requirements increase significantly only after the fifth year.

84. This aspect should also be properly assessed as this analysis of the "labour budget" will provide information on the availability of "family labour" and the requirements for hiring workers. This will also provide inputs to assess the employment opportunities generated by the project. See Table 11.

**Table 11: Labour requirements**

Guideland
Rural Development Project
Coffee Farm Model

| **LABOR BUDGET** (In Units) | | | | | | | | | **Crop year** |
|---|---|---|---|---|---|---|---|---|---|
| | | **Without Project** | **With Project** | | | | | | |
| | **Unit** | **1 to 20** | **1** | **2** | **3** | **4** | **5** | **6** | **7 to 20** |
| **Labor Requirements** | | | | | | | | | |
| Unskilled labor | manday | 421.5 | 426.5 | 435 | 401 | 415 | 456 | 499 | 577 |
| Unskilled labour for investments | manday | - | 5 | 52 | 73 | 118 | 40 | 16 | - |
| **Sub-Total Labor Requirements** | | 421.5 | 431.5 | 487 | 474 | 533 | 496 | 515 | 577 |
| **Family Labor Available** | | | | | | | | | |
| Unskilled labor | manday | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| **Hired Labor** | | | | | | | | | |
| Unskilled labor | manday | 21.5 | 26.5 | 35 | 1 | 15 | 56 | 99 | 177 |
| Unskilled labour for investments | manday | - | 5 | 52 | 73 | 118 | 40 | 16 | - |
| **Sub-Total Hired Labor** | | 21.5 | 31.5 | 87 | 74 | 133 | 96 | 115 | 177 |
| **Family Labor Use** | | | | | | | | | |
| Unskilled labor | manday | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |

85. With all these elements it is possible to **formulate the "farm budget" in financial terms**. **This is the basic tool to analyse the financial profitability of the technical proposal as well as its financial sustainability**.

**Table 12a: WOP and WP situation Budgets**

Guideland
Rural Development Project
Coffee Farm Model

| **FINANCIAL BUDGET (DETAILED)** (In $) | **Without Project** | **With Project** | | | | | | | | | | | **Crop year** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1 to 20** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12 to 20** |
| **Main Production** | | | | | | | | | | | | | |
| Cassava | 420.0 | 420.0 | 450.0 | 480.0 | 510.0 | 540.0 | 540.0 | 540.0 | 540.0 | 540.0 | 540.0 | 540.0 | 540.0 |
| Banana | 2 700.0 | 2 700.0 | 2 775.0 | 2 025.0 | 4 125.0 | 4 425.0 | 4 650.0 | 4 800.0 | 4 800.0 | 4 800.0 | 4 800.0 | 4 800.0 | 4 800.0 |
| 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 |
| Coffee | 3 780.0 | 3 780.0 | 3 024.0 | 2 268.0 | 756.0 | 1 606.5 | 2 551.5 | 4 441.5 | 4 819.5 | 5 197.5 | 5 575.5 | 5 859.0 | 6 048.0 |
| **Sub-total Main Production** | 7 091.3 | 7 102.5 | 6 676.5 | 5 223.0 | 5 841.0 | 7 021.5 | 8 191.5 | 10 231.5 | 10 609.5 | 10 987.5 | 11 365.5 | 11 649.0 | 11 838.0 |
| **Production Cost** | | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | |
| Banana suckers | - | 10.5 | 10.5 | 21.0 | - | - | - | - | - | - | - | - | - |
| Coffee seeding | - | - | 350.0 | 390.0 | 780.0 | 120.0 | 80.0 | - | - | - | - | - | - |
| Fertilizer | - | 2.8 | 46.8 | 93.5 | 176.0 | 132.0 | 88.0 | - | - | - | - | - | - |
| Chemicals | - | 2.5 | 2.5 | 5.0 | - | - | - | - | - | - | - | - | - |
| Land preparation | - | - | 90.0 | 90.0 | 180.0 | - | - | - | - | - | - | - | - |
| Equipment | - | - | 1 056.0 | 935.0 | 595.0 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | - | 15.8 | 1 555.8 | 1 534.5 | 1 731.0 | 252.0 | 168.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | | |
| Unskilled labour for investments | - | 10.0 | 104.0 | 146.0 | 236.0 | 80.0 | 32.0 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | - | 25.8 | 1 659.8 | 1 680.5 | 1 967.0 | 332.0 | 200.0 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | |
| Maize seed | 6.6 | 6.6 | 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 |
| Banana suckers | 3.2 | 3.2 | 4.4 | 4.5 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| Fertilizer | - | 8.3 | 33.0 | 55.0 | 99.0 | 115.5 | 126.5 | 126.5 | 126.5 | 126.5 | 126.5 | 126.5 | 126.5 |
| Chemicals | 25.0 | 30.0 | 32.5 | 32.5 | 32.5 | 57.5 | 82.5 | 132.5 | 132.5 | 132.5 | 132.5 | 132.5 | 132.5 |
| Sacks | 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 |
| **Sub-Total Purchased Inputs** | 40.1 | 53.8 | 91.7 | 113.9 | 162.4 | 203.9 | 239.9 | 289.9 | 289.9 | 289.9 | 289.9 | 289.9 | 289.9 |
| **Labor** | | | | | | | | | | | | | |
| Unskilled labor | 843.0 | 853.0 | 870.0 | 802.0 | 830.0 | 912.0 | 998.0 | 1 154.0 | 1 154.0 | 1 154.0 | 1 154.0 | 1 154.0 | 1 154.0 |
| **Sub-total Operating Costs** | 883.1 | 906.8 | 961.7 | 915.9 | 992.4 | 1 115.9 | 1 237.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 |
| **Sub-Total Production Cost** | 883.1 | 932.5 | 2 621.5 | 2 596.4 | 2 959.4 | 1 447.9 | 1 437.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 |
| **OUTFLOWS** | 883.1 | 932.5 | 2 621.5 | 2 596.4 | 2 959.4 | 1 447.9 | 1 437.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 | 1 443.9 |
| **Cash Flow Before Financing** | 6 208.1 | 6 170.0 | 4 055.0 | 2 626.6 | 2 881.6 | 5 573.6 | 6 753.6 | 8 787.6 | 9 165.6 | 9 543.6 | 9 921.6 | 10 205.1 | 10 394.1 |

## Table 12b: Incremental

Guideland
Rural Development Project
Coffee Farm Model
**FINANCIAL BUDGET (DETAILED)**
(In $)

| | Increments | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12 to 20** |
| **Main Production** | | | | | | | | | | | | |
| Cassava | - | 30.0 | 60.0 | 90.0 | 120.0 | 120.0 | 120.0 | 120.0 | 120.0 | 120.0 | 120.0 | 120.0 |
| Banana | - | 75.0 | -675.0 | 1 425.0 | 1 725.0 | 1 950.0 | 2 100.0 | 2 100.0 | 2 100.0 | 2 100.0 | 2 100.0 | 2 100.0 |
| Maize | 11.3 | 236.3 | 258.8 | 258.8 | 258.8 | 258.8 | 258.8 | 258.8 | 258.8 | 258.8 | 258.8 | 258.8 |
| Coffee | - | -756.0 | -1 512.0 | -3 024.0 | -2 173.5 | -1 228.5 | 661.5 | 1 039.5 | 1 417.5 | 1 795.5 | 2 079.0 | 2 268.0 |
| **Sub-total Main Production** | 11.3 | -414.8 | -1 868.3 | -1 250.3 | -69.8 | 1 100.3 | 3 140.3 | 3 518.3 | 3 896.3 | 4 274.3 | 4 557.8 | 4 746.8 |
| **Production Cost** | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | |
| Banana suckers | 10.5 | 10.5 | 21.0 | - | - | - | - | - | - | - | - | - |
| Coffee seeding | - | 350.0 | 390.0 | 780.0 | 120.0 | 80.0 | - | - | - | - | - | - |
| Fertilizer | 2.8 | 46.8 | 93.5 | 176.0 | 132.0 | 88.0 | - | - | - | - | - | - |
| Chemicals | 2.5 | 2.5 | 5.0 | - | - | - | - | - | - | - | - | - |
| Land preparation | - | 90.0 | 90.0 | 180.0 | - | - | - | - | - | - | - | - |
| Equipment | - | 1 056.0 | 935.0 | 595.0 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | 15.8 | 1 555.8 | 1 534.5 | 1 731.0 | 252.0 | 168.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | |
| Unskilled labour for investments | 10.0 | 104.0 | 146.0 | 236.0 | 80.0 | 32.0 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | 25.8 | 1 659.8 | 1 680.5 | 1 967.0 | 332.0 | 200.0 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | |
| Maize seed | - | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |
| Cassava cuttings | - | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Banana suckers | - | 1.2 | 1.4 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 |
| Fertilizer | 8.3 | 33.0 | 55.0 | 99.0 | 115.5 | 126.5 | 126.5 | 126.5 | 126.5 | 126.5 | 126.5 | 126.5 |
| Chemicals | 5.0 | 7.5 | 7.5 | 7.5 | 32.5 | 57.5 | 107.5 | 107.5 | 107.5 | 107.5 | 107.5 | 107.5 |
| Sacks | 0.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| **Sub-Total Purchased Inputs** | 13.7 | 51.6 | 73.8 | 122.3 | 163.8 | 199.8 | 249.8 | 249.8 | 249.8 | 249.8 | 249.8 | 249.8 |
| **Labor** | | | | | | | | | | | | |
| Unskilled labor | 10.0 | 27.0 | -41.0 | -13.0 | 69.0 | 155.0 | 311.0 | 311.0 | 311.0 | 311.0 | 311.0 | 311.0 |
| **Sub-total Operating Costs** | 23.7 | 78.6 | 32.8 | 109.3 | 232.8 | 354.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **Sub-Total Production Cost** | 49.4 | 1 738.4 | 1 713.3 | 2 076.3 | 564.8 | 554.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **OUTFLOWS** | 49.4 | 1 738.4 | 1 713.3 | 2 076.3 | 564.8 | 554.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **Cash Flow Before Financing** | -38.1 | -2 153.1 | -3 581.5 | -3 326.5 | -634.5 | 545.5 | 2 579.5 | 2 957.5 | 3 335.5 | 3 713.5 | 3 997.0 | 4 186.0 |
| | | | | | -9 733.8 | | | | | | | |

IRR = 20.5%, NPV = 14,419.14

86. Both are the necessary conditions for assessing the attractiveness of the technical proposal from the point of view of the beneficiaries.

87. 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 flows do not imply money disbursements; similarly, family self-consumption of cassava and/ or maize obviously do not imply monetary expenditures).

88. The comparison of the two future flows of net benefits for farm or activity model ("without and with project") leads to the determination of the flow of **net *incremental* benefits**: (**Table 12b**) i.e. the "**Cash Flow Before Financing**" in the table above presented. [35]

89. This is the flow of financial resources that should be analyzed in order to determine the profitability of the proposed technical improvements as well as its financial sustainability.

**Box No 5. Some tips for the formulation of 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 "farm-gate" prices (with information gathered "in situ").
- Avoid including "sunk costs[36]" in the "with project" situation.
- Do not include depreciation[37] in the financial budget. Otherwise, there would be "double counting" of investment costs.
- Use real prices (including the rate of interest) during the whole period of analysis, ignoring inflation (constant price at the time of project design). Forecasting nominal prices is a very difficult if not impossible task.
- The financial analysis is not a "liquidity" analysis. Therefore, all inflows and outflows

[35] The "family labour" (estimated at 400 man-days per year with a total cost of $ 800 per year) is included under the item "Unskilled Labour" together with Hired Unskilled Labour required for operations (i.e. its annual value is equivalent to the balance between the amounts included in this item and $ 800)

[36] Sunk costs are cost that has already been incurred and thus cannot be recovered, they are independent of any event that may occur in the future,

[37] Depreciation is a method of allocating the cost of a tangible asset over its useful life. For accounting purposes, depreciation indicates how much of an asset's value has been used up. For intangible assets amortization is the correct term. However these are accounting concepts that makes no sense in financial analysis. Here, during the year the asset needs to be replaced an investment costs will be computed.

(monetary and in- kind) should be taken into account.

- Self- consumption of part or total agricultural production should be valued at their market prices.
- Family labour should also be valued at its market price.

***B.*** *In order to assess the attractiveness of the proposed investment to the potential beneficiaries the "financial profitability" of the proposed productive activities for the different types of beneficiaries should be calculated.*

90. With these elements, it is possible to estimate the "financial profitability indicators" of the proposed technological improvements. This analysis is made "from the point of view" of the beneficiaries and, therefore, its conclusions would provide information on the convenience of adopting the new technical proposals as well as adoption rates for the project.

91. In the *Guideland* example project, the financial profitability indicators are shown at the end of the Farm Budget (Table 12)**. FRR=20.5 % and FNPV= 14,419.14 (discount rate 7%).**

92. The NPV is positive (for a discount rate of 7%) and the FRR is higher than 7% which leads to the conclusion that the proposed investment is convenient from a financial point of view.

93. The ***choice of the period of discount***: the 20 year-period, or financial life of the farm model, is based on the following considerations: (a) the "investment period" for coffee plantations is long: i.e. 11 years after the beginning of the investment process the plantations reach their full development. Therefore, the discount period should be longer (80 to 100%) than this investment period in order to obtain a balanced record of costs and benefits; (b) the useful life of the main on-farm investments (i.e. coffee plantations) is also taken into account. Actually, coffee plantations have a longer useful life but values obtained for years after 20 are negligible.

94. These criteria are valid for all types of farm models that include on-farm investments with long useful lives and/or long investment periods (i.e. permanent plantations, irrigation and drainage facilities, livestock development, other infrastructure, etc.). For other cases (f.i. improvement of annual crops based in the introduction of better inputs) the period of discount can be shorter but it is advisable that at least a 5-year-period of discount should be adopted.

95. The ***choice of the financial discount rate:*** the financial discount rate (FDR) is a parameter to assess the financial profitability of an investment. As above mentioned, it is used in the calculation of the NPV and it is the value of reference when FRR is used as profitability indicator. Its financial meaning is that of providing "the alternative financial returns"/ 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.

96. In order to reflect the profitability of a farm-investment in a typical IFAD production-oriented projects, this rate should be a proxy of the interest rate that could be obtained by any potential beneficiaries (i.e. small farmers).

97. Giving the very scarce investment alternatives of the rural poor, **the recommended FDR is the "passive rate of interest" of the local banking sector. In other words, the rate of interest paid to saving accounts in the local banks**[38].

98. For assessing the financial profitability of the Project "as a whole" it is recommended that an average of "passive rates of interest" in the national economy is used for estimating the relevant FDR: i.e. long-term deposit rate; saving account rates; public bonds rates; etc. This average is a good proxy of the alternative profitability of the investments for the public sector in the country.

99. In addition to these indicators of financial profitability, **it is useful to have other indicators of convenience for the project investment proposal.** In the typical case of "farm models", the following are very useful: (a) comparison of labour returns (i.e. family labour returns); (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 "with project situation" will be higher than in the "without project situation" and, when there are not crop area expansion, returns per unit of land area in the "with project" situation will be higher to those in the "without project "situation.

100. In the *Guideland Project* example, **the family labour returns in the "without project situation" are equivalent to $ 17.52 per man/day. The family labour returns in the "with project situation" (at "project full development")[39] are estimated at $ 29.85 per man/day.**

101. In addition, it is important to **show the net family incomes in the "with Project" situation**. **This indicator should be compared with other relevant indicators such as the "income poverty line**" in order 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 implies that the household would still be under the income poverty line. This should be an indicator for the project formulators to seek other productive alternatives that would ensure higher income increases.

102. In the *Guideland Project* example, the net family incomes <u>at project full development</u> reach the equivalent to $ 11 194.1. This amount is clearly higher than the income poverty line of $ 8500.

103. To better clarify this point we present information from the India "Jharkhand Tribal Empowerment and Livelihoods Project " project that shows the following results:

[38] This parameter is a "proxy" given the fact that most IFAD beneficiaries have very limited or none access to banking services.

[39] The concept of "at project full development" means the year of project-life when 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.

**Table 13: 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 | 0 | 88,714 | 0 | 2,945 | 0 | 85,769 |
| 5 | Tasar-cocoon cluster-forest based | 0 | 24,667 | 0 | 2,978 | 0 | 21,688 |
| 6 | Tasar-cocoon cluster-new plantation | 0 | 24,444 | 0 | 3,233 | 0 | 21,211 |
| 7 | Lac production clusters | 0 | 16,500 | 0 | 5,534 | 0 | 10,966 |
| 8 | Goat-rearing clusters | 0 | 43,325 | 0 | 2,200 | 0 | 41,125 |
| 9 | IGA interventions | 0 | 17,207 | 0 | 3,458 | 0 | 13,749 |

1/ at full development stage; Net income including returns from family labour

104. The absolute poverty line (i.e. USD 360 per person per year) is equivalent to INR 18 000. For households with a size equivalent to 3.5 adult persons, the absolute poverty line would be INR 63 000. In the "without project" situation, the household incomes only reach 33% of this figure while in the "with project situation", only one proposed activity (mango orchards) would reach net incomes above the poverty line. All other proposed activities achieve net incomes below the poverty line although significantly improving the without project situation.[40]

105. In brief, "the attractiveness of the investment (and project interventions) to the target group" is clearly justified by the above presented indicators. However, this is a necessary but no a sufficient condition to ensure the success of the project proposal: i.e. to effectively attract potential beneficiaries to adopt the project proposal.

106. The potential beneficiaries might positively appreciate the convenience of a technical proposal, in terms of future profitability, but **they might be unable to adopt it due to the lack of available or affordable financial resources to meet their short and long term investment requirements**.

***C.*** *Therefore, the "**financial sustainability** analysis[41]" of the proposed improvements in the productive units of the beneficiaries should also be undertaken.*

107. The financial sustainability analysis helps in the identification of the required financing resources **that will** allow the adoption of new proposed technologies (i.e. additional investments and increased working capital).

[40] It is very likely that, in this case, the households perceive "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 "without project" situation.

[41] Definition from the EU Guide to Cost-Benefit analysis of Investment Projects

108. It is crucial to discuss the results of this analysis among the design team in order to analyse existing financing resources the beneficiaries could access or to discuss the inclusion of project components related to these financing requirements: for example, access to affordable credit, grants or other type of rural finance services to finance partially or totally the required investments[42]

109. In the case of the *Guideland Project*, the proposed farm-model is profitable from a financial point of view. Nevertheless, this is a necessary but not a sufficient condition to ensure the attractiveness of this proposal to the farmer. They need to have access to the required financial resources to adopt the proposed technology and make the corresponding investments.

110. The **financial sustainability analysis** is based on the results of the **"Incremental Cash flow before financing".** In the case of the *Guideland Project* **this flow is negative during the first five years of project life (Table 12b), indicating that during the first years, costs will be higher than benefits and farmers will need external financial support to be able to cover these differences. The proposal is not financially sustainable.**

111. Actually, the required financial resources in the first four years amount to $ 9,733.7 (see table 12b). This sum is higher than the total amount of gross incomes in the "WOP situation" (i.e. $ 7,091.3-Table 12a) which is totally consumed by the rural household (for self-subsistence and cash-carry forward to finance the production inputs for the following year). In addition, given the fact that total net incomes in the "WOP situation" are lower than the income poverty-line, it is not possible to assume the existence of sufficient "family savings" that could help finance the required investments.

112. As a consequence, the "financial sustainability analysis" has shown that it is necessary to look for additional financial sources in order to ensure the adoption of the proposed technology.

113. A possible way is to find medium or long-term credit facilities to help finance the proposed investments as well as short-term funds to help finance the incremental costs of production inputs. In *Guideland* local banking/financing terms and conditions are as follows: (a) rate of interest 10%; (b) Percentage of investments to finance by long term loans: 90%; (c) Period of reimbursement for long-term loans: 7 years; (d) Period of reimbursement for short-term credit: 1 year[43]. The results of the financial sustainability analysis with these financing alternatives are as follows:

[42] Smallholder farmers need access to a wide range of financial services in order to enhance productivity and reach markets. They require: savings to respond to external shocks, smooth their income and make investments over time; working capital to finance their production costs; investment capital and access to leasing and insurance; and liquidity for their normal and extraordinary household expenditures.

[43] In other cases, a grace period could be also introduced.

## Table 14: Credit financing – Long and short term loans

Guideland
Rural Development Project
Coffee Farm Model
**FINANCIAL SUSTAINABILITY ANALYSIS**
LONG TERM CREDIT ALTERNATIVE

| (In $) | Increments | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14 to 20** |
| **Cash Flow Before Financing** | -38.1 | -2 153.1 | -3 581.5 | -3 326.5 | -634.5 | 545.5 | 2 579.5 | 2 957.5 | 3 335.5 | 3 713.5 | 3 997.0 | 4 186.0 | 4 186.0 | 4 186.0 |
| **Financial Inflows** | | | | | | | | | | | | | | |
| Disbursements on Long Term Loan | 23.2 | 1 493.8 | 1 512.5 | 1 770.3 | 298.8 | 180.0 | - | - | - | - | - | - | - | - |
| Disbursements on Short Term Loan | 106.8 | 161.7 | 115.9 | 115.4 | 126.4 | 87.6 | - | - | - | - | - | - | - | - |
| Transfer from Previous Period | - | 82.9 | 84.9 | 190.5 | 139.6 | 287.2 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| Contribution from own savings | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Grants | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Sub-Total Financial Inflows** | 129.9 | 1 738.4 | 1 713.3 | 2 076.3 | 564.8 | 554.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **Financial Outflows** | | | | | | | | | | | | | | |
| Long Term Principal | - | - | - | - | - | - | 726.1 | 798.7 | 878.5 | 966.4 | 1 063.0 | 1 169.3 | 1 286.2 | - |
| Long Term Interest | - | - | - | - | - | - | 688.8 | 616.2 | 536.3 | 448.5 | 351.9 | 245.6 | 128.6 | - |
| Short Term Principal | - | 106.8 | 161.7 | 115.9 | 115.4 | 126.4 | 87.6 | - | - | - | - | - | - | - |
| Short Term Interest | - | 7.5 | 11.3 | 8.1 | 8.1 | 8.8 | 6.1 | - | - | - | - | - | - | - |
| Transfer to Next Period | 82.9 | 84.9 | 190.5 | 139.6 | 287.2 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **Sub-Total Financial Outflows** | 82.9 | 199.2 | 363.6 | 263.6 | 410.7 | 696.0 | 2 069.3 | 1 975.6 | 1 975.6 | 1 975.6 | 1 975.6 | 1 975.6 | 1 975.6 | 560.8 |
| **Net Financing** | 47.1 | 1 539.2 | 1 349.7 | 1 812.7 | 154.1 | -141.2 | -1 508.6 | -1 414.9 | -1 414.9 | -1 414.9 | -1 414.9 | -1 414.9 | -1 414.9 | - |
| **Cash Flow After Financing** | 8.9 | -613.9 | -2 231.8 | -1 513.8 | -480.4 | 404.3 | 1 070.9 | 1 542.6 | 1 920.6 | 2 298.6 | 2 582.1 | 2 771.1 | 2 771.1 | 4 186.0 |
| **Change in Net Worth** | | | | | | | | | | | | | | |
| Contribution from own savings | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Residual value of Transfer to Next Period | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Sub-Total Change in Net Worth** | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Farm Family Benefits After Financing** | 8.9 | -613.9 | -2 231.8 | -1 513.8 | -480.4 | 404.3 | 1 070.9 | 1 542.6 | 1 920.6 | 2 298.6 | 2 582.1 | 2 771.1 | 2 771.1 | 4 186.0 |

114. The **Cash Flow After Financing**, given the Loan Term Credit terms and conditions **shows** (**in table 14) several years with negative values**. Therefore, it is not feasible to finance the proposed investments only accessing credit from existing financial institutions.

115. In fact, the problem stems not only from the need to finance investments for the new coffee plantations but from the fact that there are no credit products for financing the decrease in gross incomes due to the eradication of old coffee plants. The project team meets again and this time decide to introduces a "**Grant component**" for enhancing the re-habilitation of coffee plantations[44]. The grants would cover the total costs of the investments included in the farm model as well as additional amounts to cover the decrease in gross incomes due to the eradication of old coffee plants; in fact it will be spread over 6 years to compensate the production losses.

116. The "Cash Flow **After** Financing" shown in **table 15,** proves that for all the years of the project life, **there are no negative values. This is the best indicator for ensuring that the project proposal is "financially viable**".

117. In brief, only now is possible to justify, on 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 solid basis to assume that the investment would yield the expected financial benefits.

118. A note of precaution is necessary here, given that these results are based on the provision of a **grant**[45]. In any case, ***the financial sustainability/viability analysis should stimulate the discussion of the design team on how are going to be financed the incremental costs necessary to implement the proposed new technology.*** Do beneficiaries have enough financial resources? Do they have access to savings/credits/loans facilities? How sustainable is an approach merely based on grants? If the major bottleneck is the lack of long term credit products in the country, how this project will be contributing to remove this obstacle? Are there other interventions that the project could put in place to remove this barrier (e.g. support deposit taking financial institutions to develop medium/long term capita; guarantee schemes, etc)?

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[44] The Grant solution is only a possible alternative, chosen in this case to facilitate the analysis and because the target group is extremely poor. Helping smallholders to save and build their assets is generally a more sustainable strategy. Grants should be *one off* intervention to reduce the vulnerability of extremely poor people or promote the adoption of new technologies. Medium-term credit products developed by supporting existing financial service providers are another recommended strategy. Finally, deferred interest payment programs, (for example, Patient Capital schemes, etc.) are also recommended.

[45] Given the risks and the shortfalls associated with the establishment and management of grant facilities, including the risk to create distortions in the market, in a real case, a very cautious approach should be followed (see IFAD Technical Note on matching Grants) and alternative long term solutions analysed.

## Table 15: Grant facility

Guideland
Rural Development Project
Coffee Farm Model
**FINANCIAL SUSTAINABILITY ANALYSIS**
(In $)

| | Increments | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12 to 20** |
| **Cash Flow Before Financing** | -38.1 | -2 153.1 | -3 581.5 | -3 326.5 | -634.5 | 545.5 | 2 579.5 | 2 957.5 | 3 335.5 | 3 713.5 | 3 997.0 | 4 186.0 |
| **Financial Inflows** | | | | | | | | | | | | |
| Disbursements on Short Term Loan | 106.8 | 161.7 | 115.9 | 115.4 | 126.4 | 87.6 | - | - | - | - | - | - |
| Transfer from Previous Period | - | -83.1 | -83.1 | -83.1 | -83.1 | 267.2 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| Contribution from own savings | - | - | - | - | - | - | - | - | - | - | - | - |
| Grants | 25.8 | 2 120.0 | 3 722.2 | 3 440.8 | 987.6 | 200.0 | - | - | - | - | - | - |
| **Sub-Total Financial Inflows** | 132.6 | 2 198.6 | 3 755.0 | 3 473.1 | 1 030.8 | 554.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **Financial Outflows** | | | | | | | | | | | | |
| Short Term Principal | - | 106.8 | 161.7 | 115.9 | 115.4 | 126.4 | 87.6 | - | - | - | - | - |
| Short Term Interest | - | 7.5 | 11.3 | 8.1 | 8.1 | 8.8 | 6.1 | - | - | - | - | - |
| Transfer to Next Period | -83.1 | -83.1 | -83.1 | -83.1 | 267.2 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **Sub-Total Financial Outflows** | -83.1 | 31.1 | 89.9 | 40.9 | 390.7 | 696.0 | 654.5 | 560.8 | 560.8 | 560.8 | 560.8 | 560.8 |
| **Net Financing** | 215.7 | 2 167.5 | 3 665.0 | 3 432.2 | 640.1 | -141.2 | -93.7 | - | - | - | - | - |
| **Cash Flow After Financing** | 177.5 | 14.4 | 83.5 | 105.7 | 5.6 | 404.3 | 2 485.8 | 2 957.5 | 3 335.5 | 3 713.5 | 3 997.0 | 4 186.0 |
| **Change in Net Worth** | | | | | | | | | | | | |
| Contribution from own savings | - | - | - | - | - | - | - | - | - | - | - | - |
| Residual value of Transfer to Next Period | - | - | - | - | - | - | - | - | - | - | - | - |
| **Sub-Total Change in Net Worth** | - | - | - | - | - | - | - | - | - | - | - | - |
| **Farm Family Benefits After Financing** | 177.5 | 14.4 | 83.5 | 105.7 | 5.6 | 404.3 | 2 485.8 | 2 957.5 | 3 335.5 | 3 713.5 | 3 997.0 | 4 186.0 |

**Box No 6. The *Guideland Project*: the financial analysis leads to reformulation of the Project proposal during Project preparation**

The Financial Analysis conclusions showed that the project 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 financial scheme concluded that every farm participating in the project would need to access short-term credit products as well as build their asset base through savings; and be included in the "grant scheme" giving the lack of long-term credit facilities in the country.

As a consequence, the original Project structure should be complemented with a financial component including: (a) Saving mobilization and linkages with Financial Service providers (FSPs), (b) an "Investment Fund". The first one (with a relatively low cost) is going to be led by local FSPs. The second one (with significant costs) is going to administer all the required grants for investments and compensation of the decreases in coffee production in the first 5 years.

The preparation of this new component implies the estimation of the total amounts required for covering the 2000 expected beneficiaries.

***D.*** *The **financial analysis of the Project ("as a whole")** is a natural consequence of the previous financial analysis based on the productive-units of the beneficiaries. It will take into consideration all the data included in the "farm-models" and it will also add the costs of the project component and activities that **are not included** within the "farm-models": i.e. costs of the extension services and costs of the project administration and management, etc.*

119. This analysis is based upon the following input-data: (a) The Project Cost Tables and (b) The financial analysis of the "farm models".

120. In practical terms, it follows these steps: (i) aggregation of net incremental benefits; (ii) determination of project costs; (iii) estimation of the Project financial profitability indicators.[46]

(i) The **aggregation of net incremental benefits** of the different types of beneficiaries should be clearly presented. This requires the presentation of a clear "matrix of incorporation" of the different types and number of beneficiaries with their corresponding "farm-models".

121. As an example, the following table show the "matrix of incorporation of the Egypt "On Farm Irrigation Development Project In The Oldlands", where the total nr of beneficiaries 'households was 5,145 .

[46] As an important "sub-product" of this analysis, the soundness of the proposed financing plan for the project is going to be confirmed by the obtained results.

| Table 16: Nr of Farms participating, cumulative | | | | | |
|---|---|---|---|---|---|
| | **Y1** | **Y2** | **Y3** | **Y4** | **Y5 to Y20** |
| Vegetables for processing | 107 | 259 | 459 | 739 | 1109 |
| Spring onions for export | 107 | 259 | 459 | 739 | 1109 |
| Herbs for export | 84 | 211 | 380 | 608 | 873 |
| Grapes for Export | 137 | 303 | 503 | 723 | 1054 |
| Citrus for high end markets | 97 | 212 | 400 | 650 | 1000 |
| *Tot per Year* | 532 | 1244 | 2201 | 3459 | **5145** |

122. In the *Guideland Project* example, this "matrix of incorporation" is rather simple, as follows:

**Table 17**

Guideland
Rural Development Project

| **FARM DISTRIBUTIONS** (In Units) | **Without Project** | **With Project** | | **Crop year** |
|---|---|---|---|---|
| | **1 to 20** | **1** | **2** | **3 to 20** |
| **Number of Farms Participating** | | | | |
| Coffee | - | 500 | 1,500 | 2,000 |
| **Cropped Area Participating** | | | | |
| Coffee | - | 4,000 | 12,750 | 17,000 |
| Cropping Intensity | 75 | 76.25 | 82.5 | 85 |

123. With the information included in the farm budget and the data from the matrix of incorporation it is now possible to undertake the "aggregation" of the data for the Project "as a whole".

124. However, this task is not an easy one. 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.[47] The use of spreadsheet programmes (i.e. Excel) facilitates the data processing but it requires a careful design of the tables and a more careful data processing.

[47] This type of calculations is a "matrix multiplication".

125. In the *Guideland Project* example, there is only one farm-model and its corresponding farm budget. However, the calculation is not straight-forward and typical mistakes are double counting and/or missing some data in the calculations.

126. This process becomes even more complicated when a project includes many farm models. This is one of the great advantages of using FARMOD as a tool for the financial and economic analysis of rural development projects. This programme was designed for the EFA of agricultural development projects and one of its features is the way in which the "aggregation" problem is solved. The results obtained for the *Guideland Project* example using FARMOD are as follows:

## Table 18a: Aggregated Financial analysis – WOP/WP

Guideland
Rural Development Project

Crop year

| AGGREGATED FINANCIAL BENEFITS (In $ '000) | Without Project | With Project | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 to 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 to 20 |
| **Main Production** | | | | | | | | | | | | | | | |
| Cassava | 840.0 | 840.0 | 855.0 | 900.0 | 960.0 | 1,020.0 | 1,065.0 | 1,080.0 | 1,080.0 | 1,080.0 | 1,080.0 | 1,080.0 | 1,080.0 | 1,080.0 | 1,080.0 |
| Banana | 5,400.0 | 5,400.0 | 5,437.5 | 5,137.5 | 5,475.0 | 7,350.0 | 8,812.5 | 9,262.5 | 9,525.0 | 9,600.0 | 9,600.0 | 9,600.0 | 9,600.0 | 9,600.0 | 9,600.0 |
| Maize | 382.5 | 388.1 | 511.9 | 753.8 | 888.8 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 |
| Coffee | 7,560.0 | 7,560.0 | 7,182.0 | 6,048.0 | 4,158.0 | 2,693.3 | 3,260.3 | 5,575.5 | 8,127.0 | 9,639.0 | 10,395.0 | 11,103.8 | 11,670.8 | 12,001.5 | 12,096.0 |
| **Sub-total Main Production** | 14,182.5 | 14,188.1 | 13,986.4 | 12,839.3 | 11,481.8 | 11,963.3 | 14,037.8 | 16,818.0 | 19,632.0 | 21,219.0 | 21,975.0 | 22,683.8 | 23,250.8 | 23,581.5 | 23,676.0 |
| **Production Cost** | | | | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | | |
| Cuttings and suckers | - | 5.3 | 15.8 | 26.3 | 26.3 | 10.5 | - | - | - | - | - | - | - | - | - |
| Planting Material | - | - | 175.0 | 545.0 | 955.0 | 1,035.0 | 550.0 | 140.0 | 40.0 | - | - | - | - | - | - |
| Purchased inputs | - | 2.6 | 29.9 | 101.1 | 211.1 | 291.3 | 264.0 | 154.0 | 44.0 | - | - | - | - | - | - |
| Land preparation | - | - | 45.0 | 135.0 | 225.0 | 225.0 | 90.0 | - | - | - | - | - | - | - | - |
| Equipment | - | - | 528.0 | 1,523.5 | 1,760.5 | 1,062.5 | 297.5 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | - | 7.9 | 793.6 | 2,330.9 | 3,177.9 | 2,624.3 | 1,201.5 | 294.0 | 84.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | | | | |
| Unskilled labour for investments | - | 5.0 | 62.0 | 182.0 | 316.0 | 349.0 | 214.0 | 72.0 | 16.0 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | - | 12.9 | 855.6 | 2,512.9 | 3,493.9 | 2,973.3 | 1,415.5 | 366.0 | 100.0 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | | |
| Planting Material | 13.1 | 13.1 | 16.4 | 23.0 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 |
| Cuttings and suckers | 13.9 | 13.9 | 15.0 | 17.2 | 20.7 | 25.3 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 |
| Purchased inputs | 53.2 | 60.0 | 88.3 | 135.4 | 194.0 | 269.8 | 351.3 | 433.0 | 501.0 | 526.0 | 526.0 | 526.0 | 526.0 | 526.0 | 526.0 |
| **Sub-Total Purchased Inputs** | 80.2 | 87.1 | 119.7 | 175.5 | 240.9 | 321.3 | 405.0 | 486.8 | 554.8 | 579.8 | 579.8 | 579.8 | 579.8 | 579.8 | 579.8 |
| **Labor** | | | | | | | | | | | | | | | |
| Unskilled labor | 1,686.0 | 1,691.0 | 1,709.5 | 1,697.5 | 1,652.0 | 1,687.0 | 1,826.0 | 2,031.0 | 2,230.0 | 2,308.0 | 2,308.0 | 2,308.0 | 2,308.0 | 2,308.0 | 2,308.0 |
| **Sub-total Operating Costs** | 1,766.2 | 1,778.1 | 1,829.2 | 1,873.0 | 1,892.9 | 2,008.3 | 2,231.0 | 2,517.8 | 2,784.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 |
| **Sub-Total Production Cost** | 1,766.2 | 1,790.9 | 2,684.8 | 4,385.9 | 5,386.8 | 4,981.5 | 3,646.5 | 2,883.8 | 2,884.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 |
| **Other Costs** | | | | | | | | | | | | | | | |
| Other Costs | - | 570.0 | 855.0 | 950.0 | 1,425.0 | 1,140.0 | 665.0 | 285.0 | - | - | - | - | - | - | - |
| **OUTFLOWS** | 1,766.2 | 2,360.9 | 3,539.8 | 5,335.9 | 6,811.8 | 6,121.5 | 4,311.5 | 3,168.8 | 2,884.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 | 2,887.8 |
| **Aggregated Financial Benefits** | 12,416.3 | 11,827.2 | 10,446.6 | 7,503.3 | 4,670.0 | 5,841.8 | 9,726.3 | 13,649.3 | 16,747.3 | 18,331.3 | 19,087.3 | 19,796.0 | 20,363.0 | 20,693.8 | 20,788.3 |

## Table 18b: Aggregated Financial analysis – Increments

Guideland
Rural Development Project

| AGGREGATED FINANCIAL BENEFITS (In $ '000) | Increments | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 to 20 |
| **Main Production** | | | | | | | | | | | | | | |
| Cassava | - | 15.0 | 60.0 | 120.0 | 180.0 | 225.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 |
| Banana | - | 37.5 | -262.5 | 75.0 | 1 950.0 | 3 412.5 | 3 862.5 | 4 125.0 | 4 200.0 | 4 200.0 | 4 200.0 | 4 200.0 | 4 200.0 | 4 200.0 |
| Maize | 5.6 | 129.4 | 371.3 | 506.3 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 |
| Coffee | - | -378.0 | -1 512.0 | -3 402.0 | -4 866.8 | -4 299.8 | -1 984.5 | 567.0 | 2 079.0 | 2 835.0 | 3 543.8 | 4 110.8 | 4 441.5 | 4 536.0 |
| **Sub-total Main Production** | 5.6 | -196.1 | -1 343.3 | -2 700.8 | -2 219.3 | -144.8 | 2 635.5 | 5 449.5 | 7 036.5 | 7 792.5 | 8 501.3 | 9 068.3 | 9 399.0 | 9 493.5 |
| **Production Cost** | | | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | |
| Cuttings and suckers | 5.3 | 15.8 | 26.3 | 26.3 | 10.5 | - | - | - | - | - | - | - | - | - |
| Planting Material | - | 175.0 | 545.0 | 955.0 | 1 035.0 | 550.0 | 140.0 | 40.0 | - | - | - | - | - | - |
| Purchased inputs | 2.6 | 29.9 | 101.1 | 211.1 | 291.3 | 264.0 | 154.0 | 44.0 | - | - | - | - | - | - |
| Land preparation | - | 45.0 | 135.0 | 225.0 | 225.0 | 90.0 | - | - | - | - | - | - | - | - |
| Equipment | - | 528.0 | 1 523.5 | 1 760.5 | 1 062.5 | 297.5 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | 7.9 | 793.6 | 2 330.9 | 3 177.9 | 2 624.3 | 1 201.5 | 294.0 | 84.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | | | |
| Unskilled labour for investments | 5.0 | 62.0 | 182.0 | 316.0 | 349.0 | 214.0 | 72.0 | 16.0 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | 12.9 | 855.6 | 2 512.9 | 3 493.9 | 2 973.3 | 1 415.5 | 366.0 | 100.0 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | |
| Planting Material | - | 3.3 | 9.8 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 |
| Cuttings and suckers | - | 1.1 | 3.3 | 6.8 | 11.4 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 |
| Purchased inputs | 6.8 | 35.1 | 82.2 | 140.8 | 216.6 | 298.1 | 379.8 | 447.8 | 472.8 | 472.8 | 472.8 | 472.8 | 472.8 | 472.8 |
| **Sub-Total Purchased Inputs** | 6.8 | 39.5 | 95.3 | 160.7 | 241.0 | 324.8 | 406.5 | 474.5 | 499.5 | 499.5 | 499.5 | 499.5 | 499.5 | 499.5 |
| **Labor** | | | | | | | | | | | | | | |
| Unskilled labor | 5.0 | 23.5 | 11.5 | -34.0 | 1.0 | 140.0 | 345.0 | 544.0 | 622.0 | 622.0 | 622.0 | 622.0 | 622.0 | 622.0 |
| **Sub-total Operating Costs** | 11.8 | 63.0 | 106.8 | 126.7 | 242.0 | 464.8 | 751.5 | 1 018.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 |
| **Sub-Total Production Cost** | 24.7 | 918.6 | 2 619.7 | 3 620.6 | 3 215.3 | 1 880.3 | 1 117.5 | 1 118.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 |
| **Other Costs** | | | | | | | | | | | | | | |
| Other Costs | 570.0 | 855.0 | 950.0 | 1 425.0 | 1 140.0 | 665.0 | 285.0 | - | - | - | - | - | - | - |
| **OUTFLOWS** | 594.7 | 1 773.6 | 3 569.7 | 5 045.6 | 4 355.3 | 2 545.3 | 1 402.5 | 1 118.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 |
| **Aggregated Financial Benefits** | -589.1 | -1 969.7 | -4 912.9 | -7 746.3 | -6 574.5 | -2 690.0 | 1 233.0 | 4 331.0 | 5 915.0 | 6 671.0 | 7 379.7 | 7 946.7 | 8 277.5 | 8 372.0 |

127. The main obtained result is the "net incremental benefits"/ "Aggregated Financial benefits" flow for the overall number of beneficiaries.

128. The next step in the analysis is to calculate the financial profitability of the Project "as a whole". Now is necessary to identify the different type of Costs involved in the project: (a) It is important to notice that the "incremental production costs" included in the farm models, are part of the "Project Costs", for the pertinent period of the project-life (i.e. seven years). These costs are partially financed by some "project component" (for example, by means of "grants" or through a credit fund) and/or by the beneficiaries contributions[48]. The source of financing of these costs must be clearly reflected in the Project Financing Plans; (b) The "other costs" to be considered are the costs of the "other components" that help the beneficiaries carry out the proposed innovations.

(ii) **Project Costs** are determined according to the different project components and categories of expenditure. Usually, the tool utilized is COSTAB where a break-down of costs is provided following different criteria (f.e. by components, by expenditures accounts, by years, etc.).

129. For the *Guideland Project*, the project components would be: (a) the Extension services (identified at project inception); (b) the Investment Fund (identified during project preparation and financial analysis); and (c) the Project Management Unit (with higher costs than the original estimate due to personnel increases for managing the Investment Fund). Therefore, total costs of the *Guideland Project* are as follows:

**Table 19***

| Guideland Rural Development Project | Years | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
| **Project Costs by components** (In $ '000) | | | | | | | | |
| 1. Extension services | 420 | 705 | 800 | 1275 | 990 | 545 | 165 | 4,900 |
| 2. Investment Fund | 12.9 | 3180 | 7444.4 | 6881.6 | 1975.2 | 400 | - | 19,894 |
| 3. Short Credit Fund | 12.7 | 55.5 | 51.3 | 7.3 | 32.6 | 44.2 | 10.7 | 214.4 |
| 4. Project management Unit | 150 | 150 | 150 | 150 | 150 | 120 | 60 | 930 |
| Total Base- Costs | 595.6 | 4,090.5 | 8,445.7 | 8,313.9 | 3,147.8 | 1,109.2 | 235.7 | 25,938.5 |

* No physical contingencies have been identified. Price contingencies are excluded from the financial and economic analysis.

[48] If the "with project situation" implies that the beneficiaries should work more man-days that in the "without project situation", these incremental man-days should be considered as beneficiaries contributions to total project costs.

130. Hence, Project Costs have increased, from the original estimate of $ 6.5 million to almost $ 26 million, due to the inclusion of the Investment Fund component and the Short-term Credit Fund, originated in the conclusions of the financial sustainability analysis.

131. The proposed **Financial Plan** by component for the Project is as follows:

**Table 20***

| Guideland Rural Development Project | Financing Plan | | | | |
|---|---|---|---|---|---|
| | Gov | IFAD | Local Banks | Beneficiaries | Total |
| **Project Costs** (In $ '000) | | | | | |
| 1. Extension services | 2 450.0 | 2 450.0 | - | - | 4 900.0 |
| 2. Investment Fund | - | 19 894.1 | - | - | 19 894.1 |
| 3. Short Credit Fund | - | - | 163.3 | 51.0 | 214.4 |
| 4. Project management Unit | 465.0 | 465.0 | - | - | 930.0 |
| Total Base- Costs | 2 915.0 | 22 809.1 | 163.3 | 51.0 | 25 938.5 |

* Beneficiaries contributions correspond to the interest paid for short-term loans.

132. I**n order to avoid a double-counting of project cost, all these Project Costs should not be included in the Financial Analysis of the Project "as a whole"; only those costs that are not part of the "on farm" costs should be considered.**

133. In the *Guideland Project* example, the only costs that should be added in table 21b as "Other Costs" are those: 1) related to the extension services component; 2) from the project management component and 3) the interests paid for the short-term loans (by beneficiaries). A total of 5,881$.

(iii) The estimation of the **financial profitability indicators** is performed on the flow of financial net incremental benefits for the Project as a whole. The discount period is a 20-year-period.

## Table 21a: Financial Budget Aggregated – WOP/WP

Guideland
Rural Development Project

| FINANCIAL BUDGET (AGGREGATED) (In $ '000) | Without Project | With Project | | | | | | | | | | | | | Crop year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 to 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 to 20 |
| **Main Production** | | | | | | | | | | | | | | | |
| Cassava | 840.0 | 840.0 | 855.0 | 900.0 | 960.0 | 1 020.0 | 1 065.0 | 1 080.0 | 1 080.0 | 1 080.0 | 1 080.0 | 1 080.0 | 1 080.0 | 1 080.0 | 1 080.0 |
| Banana | 5 400.0 | 5 400.0 | 5 437.5 | 5 137.5 | 5 475.0 | 7 350.0 | 8 812.5 | 9 262.5 | 9 525.0 | 9 600.0 | 9 600.0 | 9 600.0 | 9 600.0 | 9 600.0 | 9 600.0 |
| Maize | 382.5 | 388.1 | 511.9 | 753.8 | 888.8 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 | 900.0 |
| Coffee | 7 560.0 | 7 560.0 | 7 182.0 | 6 048.0 | 4 158.0 | 2 693.3 | 3 260.3 | 5 575.5 | 8 127.0 | 9 639.0 | 10 395.0 | 11 103.8 | 11 670.8 | 12 001.5 | 12 096.0 |
| **Sub-total Main Production** | 14 182.5 | 14 188.1 | 13 986.4 | 12 839.3 | 11 481.8 | 11 963.3 | 14 037.8 | 16 818.0 | 19 632.0 | 21 219.0 | 21 975.0 | 22 683.8 | 23 250.8 | 23 581.5 | 23 676.0 |
| **Production Cost** | | | | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | | |
| Cuttings and suckers | - | 5.3 | 15.8 | 26.3 | 26.3 | 10.5 | - | - | - | - | - | - | - | - | - |
| Planting Material | - | - | 175.0 | 545.0 | 955.0 | 1 035.0 | 550.0 | 140.0 | 40.0 | - | - | - | - | - | - |
| Purchased inputs | - | 2.6 | 29.9 | 101.1 | 211.1 | 291.3 | 264.0 | 154.0 | 44.0 | - | - | - | - | - | - |
| Land preparation | - | - | 45.0 | 135.0 | 225.0 | 225.0 | 90.0 | - | - | - | - | - | - | - | - |
| Equipment | - | - | 528.0 | 1 523.5 | 1 760.5 | 1 062.5 | 297.5 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | - | 7.9 | 793.6 | 2 330.9 | 3 177.9 | 2 624.3 | 1 201.5 | 294.0 | 84.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | | | | |
| Unskilled labour for investments | - | 5.0 | 62.0 | 182.0 | 316.0 | 349.0 | 214.0 | 72.0 | 16.0 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | - | 12.9 | 855.6 | 2 512.9 | 3 493.9 | 2 973.3 | 1 415.5 | 366.0 | 100.0 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | | |
| Planting Material | 13.1 | 13.1 | 16.4 | 23.0 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 |
| Cuttings and suckers | 13.9 | 13.9 | 15.0 | 17.2 | 20.7 | 25.3 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 | 27.5 |
| Purchased inputs | 53.2 | 60.0 | 88.3 | 135.4 | 194.0 | 269.8 | 351.3 | 433.0 | 501.0 | 526.0 | 526.0 | 526.0 | 526.0 | 526.0 | 526.0 |
| **Sub-Total Purchased Inputs** | 80.2 | 87.1 | 119.7 | 175.5 | 240.9 | 321.3 | 405.0 | 486.8 | 554.8 | 579.8 | 579.8 | 579.8 | 579.8 | 579.8 | 579.8 |
| **Labor** | | | | | | | | | | | | | | | |
| Unskilled labor | 1 686.0 | 1 691.0 | 1 709.5 | 1 697.5 | 1 652.0 | 1 687.0 | 1 826.0 | 2 031.0 | 2 230.0 | 2 308.0 | 2 308.0 | 2 308.0 | 2 308.0 | 2 308.0 | 2 308.0 |
| **Sub-total Operating Costs** | 1 766.2 | 1 778.1 | 1 829.2 | 1 873.0 | 1 892.9 | 2 008.3 | 2 231.0 | 2 517.8 | 2 784.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 |
| **Sub-Total Production Cost** | 1 766.2 | 1 790.9 | 2 684.8 | 4 385.9 | 5 386.8 | 4 981.5 | 3 646.5 | 2 883.8 | 2 884.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 |
| **Other Costs** | | | | | | | | | | | | | | | |
| Other Costs | - | 570.8 | 859.4 | 957.5 | 1 432.3 | 1 149.0 | 676.3 | 235.7 | - | - | - | - | - | - | - |
| **OUTFLOWS** | 1 766.2 | 2 361.7 | 3 544.2 | 5 343.4 | 6 819.1 | 6 130.5 | 4 322.8 | 3 119.5 | 2 884.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 | 2 887.8 |
| **Cash Flow** | 12 416.3 | 11 826.4 | 10 442.2 | 7 495.8 | 4 662.7 | 5 832.8 | 9 715.0 | 13 698.6 | 16 747.3 | 18 331.3 | 19 087.3 | 19 796.0 | 20 363.0 | 20 693.8 | 20 788.3 |

## Table 21b: Financial Budget Aggregated – Increments

Guideland
Rural Development Project

| FINANCIAL BUDGET (AGGREGATED) (In $ '000) | Increments | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 to 20 |
| **Main Production** | | | | | | | | | | | | | | |
| Cassava | - | 15.0 | 60.0 | 120.0 | 180.0 | 225.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 |
| Banana | - | 37.5 | -262.5 | 75.0 | 1 950.0 | 3 412.5 | 3 862.5 | 4 125.0 | 4 200.0 | 4 200.0 | 4 200.0 | 4 200.0 | 4 200.0 | 4 200.0 |
| Maize | 5.6 | 129.4 | 371.3 | 506.3 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 | 517.5 |
| Coffee | - | -378.0 | -1 512.0 | -3 402.0 | -4 866.8 | -4 299.8 | -1 984.5 | 567.0 | 2 079.0 | 2 835.0 | 3 543.8 | 4 110.8 | 4 441.5 | 4 536.0 |
| **Sub-total Main Production** | 5.6 | -196.1 | -1 343.3 | -2 700.8 | -2 219.3 | -144.8 | 2 635.5 | 5 449.5 | 7 036.5 | 7 792.5 | 8 501.3 | 9 068.3 | 9 399.0 | 9 493.5 |
| **Production Cost** | | | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | |
| Cuttings and suckers | 5.3 | 15.8 | 26.3 | 26.3 | 10.5 | - | - | - | - | - | - | - | - | - |
| Planting Material | - | 175.0 | 545.0 | 955.0 | 1 035.0 | 550.0 | 140.0 | 40.0 | - | - | - | - | - | - |
| Purchased inputs | 2.6 | 29.9 | 101.1 | 211.1 | 291.3 | 264.0 | 154.0 | 44.0 | - | - | - | - | - | - |
| Land preparation | - | 45.0 | 135.0 | 225.0 | 225.0 | 90.0 | - | - | - | - | - | - | - | - |
| Equipment | - | 528.0 | 1 523.5 | 1 760.5 | 1 062.5 | 297.5 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | 7.9 | 793.6 | 2 330.9 | 3 177.9 | 2 624.3 | 1 201.5 | 294.0 | 84.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | | | |
| Unskilled labour for investments | 5.0 | 62.0 | 182.0 | 316.0 | 349.0 | 214.0 | 72.0 | 16.0 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | 12.9 | 855.6 | 2 512.9 | 3 493.9 | 2 973.3 | 1 415.5 | 366.0 | 100.0 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | |
| Planting Material | - | 3.3 | 9.8 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 | 13.1 |
| Cuttings and suckers | - | 1.1 | 3.3 | 6.8 | 11.4 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 | 13.6 |
| Purchased inputs | 6.8 | 35.1 | 82.2 | 140.8 | 216.6 | 298.1 | 379.8 | 447.8 | 472.8 | 472.8 | 472.8 | 472.8 | 472.8 | 472.8 |
| **Sub-Total Purchased Inputs** | 6.8 | 39.5 | 95.3 | 160.7 | 241.0 | 324.8 | 406.5 | 474.5 | 499.5 | 499.5 | 499.5 | 499.5 | 499.5 | 499.5 |
| **Labor** | | | | | | | | | | | | | | |
| Unskilled labor | 5.0 | 23.5 | 11.5 | -34.0 | 1.0 | 140.0 | 345.0 | 544.0 | 622.0 | 622.0 | 622.0 | 622.0 | 622.0 | 622.0 |
| **Sub-total Operating Costs** | 11.8 | 63.0 | 106.8 | 126.7 | 242.0 | 464.8 | 751.5 | 1 018.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 |
| **Sub-Total Production Cost** | 24.7 | 918.6 | 2 619.7 | 3 620.6 | 3 215.3 | 1 880.3 | 1 117.5 | 1 118.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 |
| **Other Costs** | | | | | | | | | | | | | | |
| Other Costs | 570.8 | 859.4 | 957.5 | 1 432.3 | 1 149.0 | 676.3 | 235.7 | - | - | - | - | - | - | - |
| **OUTFLOWS** | 595.5 | 1 778.0 | 3 577.2 | 5 052.9 | 4 364.3 | 2 556.6 | 1 353.2 | 1 118.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 | 1 121.5 |
| **Cash Flow** | -589.9 | -1 974.1 | -4 920.4 | -7 753.6 | -6 583.5 | -2 701.3 | 1 282.3 | 4 331.0 | 5 915.0 | 6 671.0 | 7 379.7 | 7 946.7 | 8 277.5 | 8 372.0 |

IRR = 16.1%, NPV = 20,418.61

134. Although it can be argued that this stage of the analysis has little theoretical use, this IG recommends, , to calculate the financial profitability indicators of the project as a whole due to the fact that: (a) the economic analysis is going to be undertaken using the same basic data and tables and, therefore, these calculations are useful in practical terms; and (b) the comparison between the financial profitability indicators the economic profitability indicators might be very meaningful since the gap between the two is an indicator of the degree of market distortions that affect the economy under analysis.

***Economic analysis:***

135. The next step is to undertake the economic analysis which is performed from the perspective of the "economy or society as a whole" and this might be quite different from the perspective of the project beneficiaries, that was the one used during the financial analysis.

136. In practical terms, what is necessary to be done is to move from financial to economic analysis, starting from the information used in the Table 20, we need to apply, appropriate conversion factors to each of the inflow or outflow items to create a new account which will also include social benefits and social costs.

**Box No 7.The choice of unit of account (numeraire): domestic currency or foreign currency?**

One of the earliest decisions that an economic analyst faces is the choice of currency and price level in which to conduct the analysis. **Financial analysis is usually conducted in the project's country currency and at prevailing market prices**. Economic analysis can be conducted in domestic **or** foreign currency and at domestic **or** border price levels.

However, to integrate financial, fiscal and economic analyses and to assess risk and sustainability, both the financial and economic analyses should be expressed in the same unit of account. When the financial analysis is done in one unit of account and the economic analysis in another, the differences between the financial and the economic values have no meaning. For these reasons**, this IG recommends the use of domestic currency at the domestic price level for the unit of account both in financial and economic analyses.**

137. In practical terms, the two main differences between the economic and the financial analysis are: (i) the consideration of "externalities"; and, (ii) the use of "shadow prices" that might differ from the "market prices" in order to eliminate market distortions and reflect the effective opportunity costs for the economy, thus achieving a proper valuation of economic costs and benefits from the perspective of the economy as a whole.

138. The economic analysis should be carried out with the following steps:

*(a) Clear and sufficient information should be provided in terms of the number and type of expected economic benefits and costs of the project, including **the identification of externalities**. This information should be clearly linked with the project objectives and components as well as with the different types of expected economic benefits.*

139. The results of the financial analysis provide the basis for the identification of **direct** benefits and costs of the Project.

140. However, this analysis does not include all benefits and costs for the society as a whole. Occasionally, a project uses resources without paying for them (i.e. natural resources, or a new irrigation project may lead to the spread of a livestock disease). At times, a project generates resources to other economic agents that do not pay for them (i.e. improvements in the quality of honey given the introduction of new pastures).

141. These effects, known as **"externalities**," are real costs and benefits for the economy as a whole attributable to the project and should be included in the economic analysis as project costs or as project benefits. Conceptually, the externalities problem is quite simple and can be described as a difference between the benefits (costs) that accrue to society and the benefits (costs) that accrue to the project entity.

142. There are many examples of externalities associated with agricultural productive projects that can be measured without major difficulties due to the fact that their effects have market impacts. For example, the value of the livestock losses due to a new disease, the value of incremental honey production, etc. are all cases in which the externalities (positive and negative) can be easily measured. In these cases, the positive externalities should be clearly identified and added to the flow of project benefits while the negative externalities should also be clearly identified and added to the flow of project costs.

143. However, valuing externalities can sometimes be difficult (particularly environmental impacts), 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 be quantified and valued.[49] In these cases, the impacts should at least be identified in physical terms for a qualitative appraisal in order to give the decision-maker more elements for an informed decision, by weighing up the quantifiable aspects, summarised in the economic rate of return, against the less quantifiable ones.

(b) *Transfer payments should be cancelled*.

144. For the economy as a whole, **subsidies and taxes** are mere "transfer payments" that do not imply real economic costs or benefits. Therefore, all "market prices" used in the financial analysis should be corrected by eliminating the effects of indirect taxes and/or subsidies.

145. In practical terms, this implies following these **general rules**:

- All prices of inputs and outputs should be net of indirect taxes (i.e. VAT , sale taxes, etc.);
- All prices of inputs and outputs should be net of indirect subsidies (i.e. subsidies to the price of energy, subsidies to the price of transportation, etc.);
- Prices of inputs, including labour, to be considered in the economic analysis should be gross of direct taxes;

[49] See Section VI for more information.

(c) *Market distortions should be corrected with the use of appropriate "**shadow prices**"*[50].

146. The key concept is the use of shadow prices, based on the social opportunity cost, instead of observed market "distorted" prices.

147. Observed prices of inputs and outputs may not mirror their social value (i.e. their social opportunity cost) because some markets are socially inefficient or do not exist at all. Examples are monopoly or oligopoly markets, where the price includes a mark-up over marginal costs; trade barriers, where the consumer pays more than elsewhere; fixed exchange rate controlled by the government; etc. Prices as they emerge from imperfect markets and from some public sector pricing or rationing policies, may fail to reflect the opportunity cost of inputs.

148. When market prices do not reflect the social opportunity cost of inputs and outputs, the usual approach is to ***convert them into shadow prices using appropriate conversion factors***, if and when, available from the national planning authority. When national authorities do not provide these information, this is not the case, the analysis needs to come up with sensible conversion factors to adjust mainly:

149. (a) Labour (wages); (b) Tradable goods; (c) Non tradable goods; (d) Foreign exchange rate; (e) The rate of discount.

**(a) The shadow price for Labour (SW):**

150. A crucial input in rural investment productive 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 the real world, however, wage distortions are very frequent. Current wages may be a distorted social indicator of the opportunity cost of labour because labour markets are imperfect, or there are macroeconomic imbalances, as revealed particularly by high and persistent unemployment, or by dualism and segmentation of labour conditions (e.g. when there is an extensive informal or illegal economy).

151. Typically, IFAD projects are undertaken in economies characterised by extensive unemployment or underemployment. Therefore, the opportunity cost of labour used in the project should be lower than the actual wage rates. The shadow wage is region-specific, because labour is less mobile than capital. It may often be determined as:

- the shadow wage for unskilled workers drawn to the project from unemployment: it can be assumed to be equal to or not less than the value of unemployment benefits;
- the shadow wage for unskilled workers drawn to the project from informal activities: it should be equal or not more than the value of the output forgone in these activities.

[50] Also known as "accounting prices" or "economic prices".

- Under severe unemployment conditions 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 rate in the region is estimated at 30%, then, the shadow wage would be 0.7 (105$) of the market wage (150$)

**(b) The shadow price for traded and tradable goods[51]:**

152. For various reasons, domestic market prices typically do not reflect the opportunity costs to the country. Market prices for tradable goods (project inputs and outputs) are usually distorted by market imperfections (i.e. monopoly, oligopolies, etc.) as well as by economic policies (trade policies, foreign exchange policies, etc.).

153. To approximate the opportunity costs to the country**,** the valuation of tradable inputs and outputs in economic analysis should rely on "border" rather than on domestic market prices.

154. Therefore, the opportunity cost of a given tradable good is based on its "border price" which means its international market price adjusted by transport and other related costs. In practical terms: ***the CIF price for imported (able) inputs and the FOB price for exported (able) goods.***[52] Note of precaution: see box nr 8! The "border prices" needs to be converted into domestic currency by applying the "***shadow rate of exchange***" to get the correct "economic price" of the tradable good. [53]

**Box No 8. Again the Numeraire: different methods to value tradable goods**

For purposes of economic analysis**, when using domestic currency at domestic price level as unit of account** (approach recommended by this IG), the prices of tradable goods and services are valued at the "border price".

(a) When the border price (due to the lack of local data) is obtained from international data sources, it will be expressed in foreign currency. Therefore, it should be converted into domestic currency at a "shadow" exchange rate to get the final "shadow price".
(b) When the border price is estimated in the country by correcting the domestic market price with the identified trade distortions (i.e. deducting import duties and adding export taxes), it will be expressed in domestic currency. Therefore, to obtain

[51] Traded goods include those that are either imported or exported by the country. Tradable goods include all traded goods and goods that the country could import (or export) under conditions of free trade, but it does not trade because of such trade barriers as import duties. Material inputs are normally tradable goods.

[52] The analysts can easily find international prices for most agricultural commodities and prices for most agricultural inputs in FAOSTAT. When prices are not available through these sources, the analyst should take the internal market price and discount tariff rates to get a proxy of the CIF price (or add export taxes to get a proxy of the FOB price).

[53] 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 exported by the European Union. Also, some "internal prices" might be the result of explicit national policies based upon the argument of "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 justified to adopt the internal price s instead of the "border" ones, at least for part of the projected period of analysis.

the final "shadow price" it should be multiplied by the CF=SER/OER where SER is the Shadow Exchange Rate and OER is the Official Exchange Rate.

Sometimes, the economic analysis is performed using foreign currency at border price (all prices expressed in USD). If this is the case, the prices of tradable good and services should be equivalent to the border prices expressed in foreign currency. Notice that in this case, the prices of non-tradable goods in domestic currency should be converted to dollars using the shadow exchange rate (dividing price in domestic currency by SER).

**(c) The shadow price for non-tradable goods[54]:**

155. If there are no major indications that a significant market-distortion (i.e. monopoly, rationing policies, etc.) is affecting one or more of project non-tradable goods, then **the recommendation is to use market prices as shadow prices for these goods and services (CF=1).**

156. When exceptional cases occur, shadow prices should be estimated based upon long run marginal cost or willingness-to-pay methods.[55] 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.

**(d) The shadow price for the exchange rate**

157. In some cases, the official, or even the market, exchange rates may not reflect the economic value in units of domestic currency of a unit of foreign exchange. Trade policies (e.g., import duties, quantitative restrictions, export subsidies, export taxes) distort not only individual prices of goods, but also the price of foreign exchange for the economy as a whole. Whenever serious trade distortions are present, border prices need to be converted into domestic currency equivalents using a **shadow exchange rate**, not the official or market exchange rate.

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[54] Non-tradable goods are those that by their nature either cannot be traded or are uneconomical to trade internationally. Land, real estates, hotel accommodations, electricity (in some cases), health services, haircuts, and other services are typically non-tradable. 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, a good falls into this category if its CIF cost (landed price) is greater than the local cost, preventing importation, *and*, at the same time, its local cost is greater than the FOB price, impeding exportation.

[55] See : Guide to cost benefit analysis of investment projects. European Union. The willingness-to-pay (WTP) approach, which allows the estimation of a money value through users' revealed preferences or stated preferences. In other words, 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 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 appropriated.

158. A **shadow exchange rate** is appropriate even if there are no balance-of-payments problems, or if the official exchange rate is allowed to adjust freely. The relevant question is whether there are trade distortions or barriers: i.e. import duties, export taxes or subsidies and/or quantitative restrictions.

159. In general, the shadow exchange rate equals the market (or official) exchange rate only if all trade distortions, such as import duties and export taxes, are eliminated. Because most countries impose import duties and some grant export subsidies, it is generally good practice to adjust the market exchange or official exchange rate for these distortions.

160. Usually, a reliable estimation of the Shadow Price for Exchange rate is calculated by the national planning agencies . When this information is not available, the analyst should estimate the following:

$$SER = \frac{\sum_{t=1}^{n}\left[ OER_t\left(\frac{CI_t}{CO_t}\right)\right]}{n}$$

Where;

**SER**: Shadow Exchange Rate

**OER**: Official Exchange Rate

**$CI_t$**: Inflows of foreign exchange for year t. ( In the balance of Payment account, this includes Exports of goods, exports of services; other intangible inflows).

**$CO_t$**: Outflows of foreign exchange for year t. ( In the balance of Payment account, this includes Imports of goods, imports of services; other intangible outflows).

**n:** number of years of the period under analysis (at least, five years).

161. In brief, this is an analysis of the country's Current Account of the Balance of Payments . Notice that if CI=CO, the Current Account would be in equilibrium and, therefore, SER=OER. When there is a Deficit in the Current Account (CI<CO), the SER would be higher than the OER. On the contrary, when there is a surplus in the current account (CI>CO), the SER would be lower than the OER. [56]

162. When there are serious restrictions on data availability and/or time constraints, an acceptable "proxy" to the SER is the follow[57]:

[56] The theoretical definition of SER involves many other determinations such as the consideration of international financial flows, degree of external indebtnes, etc.

[57] Rigorously, this approach should also be adopted if the Current Account balance is in equilibrium.

$$SER = OER \cdot \frac{\left[(M + Tm) + (X - Tx)\right]}{(M + X)}$$

Where:

SER: Shadow Exchange rate

OER: Official Exchange rate

M: Total imports (an average of five years would be advisable)

X: Total Exports (an average of five years would be advisable)

Tm: Duties on Imports

Tx: Export Taxes.

163. **This IG recommends the use of the last proposed method when there are no official calculations of the SER provided by the national planning authorities**. The existence of marginal or "black" market rates of foreign exchange is a clear indicator that there are significant distortions in the foreign exchange market. However, these rates always overestimate the value of the foreign exchange and are not acceptable as correct economic or shadow prices.

**Box No 9. Conversion Factors**

Many analysts use *conversion factors **(CF)*** to conduct economic analysis of projects. A conversion factor is the ratio of an item's shadow price to its financial price.

Whether the analyst uses conversion factors or shadow prices does not alter the conclusions of the analysis. In many cases, however, conversion factors are more convenient than shadow prices: (a) conversion factors can be applied directly to the financial data; (b) as long as the underlying distortions remained unchanged, conversion factors calculated for one project can be applied to other projects in the same country.

The calculation of conversion factors is straightforward if we know the shadow and financial prices.

Take for example the price of coffee used in the *Guideland Project* example. Remember that it was expressed in local currency at domestic price level.

Calculation of the "shadow or economic price": The market price (financial price) is $ 1.89 /kg. There is an export tax of 15% and therefore, the "border price" in domestic currency is equivalent to $ 2.17 /kg (which is consistent with FOB prices and international statistic data). The "border price" is NOT the "economic or shadow price" of coffee.

To obtain it, it is necessary to multiply the "border price" by the ratio of the "shadow rate of exchange"/ official rate of exchange (i.e. 1.2). Therefore, the economic price of coffee would be **$ 2.61** /kg.

Alternatively, the ratio of the "economic price" to the "financial price" is the Conversion factor for coffee: 2.61/1.89= **1.38=CF. Therefore, by multiplying the "financial price" ($1.89) per CF (1.38), we obtain the correct "economic price" for the coffee= $ 2.61.**

National planning agencies often have calculated CF for their main export and import goods. In these cases, the analyst only needs to apply them to the "financial market prices" used in the

financial analysis to convert them into economic prices.

Otherwise, the analyst needs to undertake the detailed calculation of the pertinent "economic prices": (i) identify the proper "border price" (FOB for exportable and CIF for importable) and (ii) apply the shadow exchange rate to the obtained border price to get the final "economic price".

**(e) The social rate of discount**

164. Costs and benefits occurring at different times need to be discounted. 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.

165. It may differ 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, etc.).

166. 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 inter-temporal demand curve (savings curve). It can be viewed either as the "scarcity price" of capital resources or as the "price of future generations consumption".

167. The essential economic role of the social rate of discount is to help allocate public investment funds to the socially most desirable uses. If the SRD 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.

168. The social rate of discount should, in principle, be uniform for the whole period of analysis.

169. 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 social rate of discount** to be used in the evaluation of investment projects **(SRD= r)**. Among the existing interest rates on the relevant world capital market, the rate of interest on long-term loans would be the appropriate basis for estimation of the social rate of discount.

**Box No 10. Social Rates of Discount according to different sources**

- The World Bank applies a "typical" social rate of discount of 10%, based upon its experiences" in the last decades.
- The European Union applies a SDR = 5%.
- As an example, the justification of a 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).

170. As **a general rule, when a country is a capital borrower, the social rate of discount should be no less than the actual rate of interest on the capital market from which the capital is borrowed.**

171. There are circumstances in which different rates of discount are suggested ("special cases"): such is the case when government are given priority to the rapid development of some less-developed regions . The speeding up of their development may be justified on social, economic and political grounds, e.g. better income distribution, employment, politically sensitive areas etc. the strict application of a uniform rate of discount may prevent the projects from passing the absolute efficiency test and therefore from promoting the development of these backward regions. The rationale behind the suggested approach is that it is more expedient to lower the rate of discount instead of trying to estimate the project's impact on distributional policy objectives and additional expected future benefits. This means that a differentiation in the SRD for backward regions may be desirable. The decision of setting up regional SRDs should be taken by a national policy-making institution consistent with the regional development policy of the Government. The special (lower) SRD for a given industry/region could be estimated as follows:

$$ri = SRD - i$$

where:
*ri* = a special promotional SRD for a given industry/region,
SRD = uniform social rate of discount,
*i* = premium for an industry or a region leading to the lowering of SRD

By definition, all IFAD projects can be considered as "special cases". [58]

172. In practical terms, **this IG recommends to adopt a SDR equivalent to the rate of interest that corresponds to IFAD´s Ordinary lending terms[59].** Still, whenever financial market conditions results in an interest rate lower than 5% (as it is the case since 2007 thanks to the financial global crisis), it is suggested as it is common practice in other IFIs (i.e. EU, see box Nr 10), to use a rate of 5% as a minimum threshold.

173. Also, in practical terms, this **IG recommends to adopt a discount period of 20 years for the economic analysis of IFAD Projects**. Whenever a different period of discount is adopted, specific justifications should be provided.

**The economic analysis of *the Guideland Rural Development Project***

174. Based upon the results of the Financial Analysis of the Project "as a whole", it is possible to undertake the economic analysis of the project.

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[58] In this sense, there is a strong argument to propose that the SDR for IFAD projects should be lower than the one obtained by the general rule.

[59] IFAD ordinary terms loans apply an "average rate" based on world market rates. At present equivalent to 1.39% reflecting the current situation in financial markets.
http://www.ifad.org/operations/projects/lending.htm

(1) *Identification and valuation of externalities*:

175. The *Guideland Project* has no identified positive or negative externalities.

(2) *Transfer payments should be cancelled*.

176. There are no indirect subsidies that affect the prices of project outputs and/or inputs. Nevertheless, there is a VAT of 10% on all goods and professional services.

177. The VAT should be deducted from the "financial market prices" (see Table 22) of all project outputs and all project inputs, including the "other costs" of the Project[60]:

*(3) Market distortions should be corrected with the use of appropriate "shadow prices"*

178. Non tradable goods are valued at their market prices (i.e. equivalent to those used in the financial analysis) since no major market distortions have been identified.

179. The Labour market wage is considered too high since structural unemployment reaches 30% of total available active economic population in the project area. Therefore**, the "shadow wage rate" has been estimated at 0.7 of market price,** equivalent to $ 1.4 per man-day.

180. Tradable goods require the corrections of their market price by adequate "shadow prices" since the country is imposing heavy export taxes and import duties (i.e. an export tax of 15% and an import duty of 25%).

181. In addition, the National Planning Authorities have determined that the SER is equivalent to USD 1= 1.38 $ while the OER is USD 1= $ 1.15. Therefore, the ratio SER/OER=1.2 (This ratio is also known as the **Standard Conversion Factor**-SCF-)

182. In order to convert the "financial prices without VAT" into economic prices for all tradable goods, these need to be identified: all production outputs and all purchased inputs, including equipment, are tradable goods; as well as all goods included in the Other Costs of the Project (i.e. local professionals and technicians are considered as tradable services). While planting material are considered non-tradable and valued at its market price.

[60] In practical terms, the COSTAB data usually provides the required information for discounting the VAT from the total project base-costs.

**Table 22: Cancellation of transfer payments**

Guideland
Rural Development Project
**PRICES WITHOUT VAT**
(In $)

| | Unit | |
|---|---|---|
| **Outputs** | | |
| Cassava | kg | 0.1091 |
| Banana | kg | 0.2727 |
| Maize | kg | 0.2045 |
| Coffee | kg | 1.718 |
| **Inputs** | | |
| **Planting Material** | | |
| Maize seed | plant | 0.3409 |
| Cassava cuttings | plant | 0.8636 |
| Banana suckers | plant | 0.0273 |
| Coffee seeding | plant | 0.1818 |
| **Purchased inputs** | | |
| Fertilizer | kg | 0.2 |
| Chemicals | kg | 4.545 |
| Sacks | sack | 0.3636 |
| Land preparation | unit | 90 |
| Equipment | unit | 2350.7 |
| **Labor** | | |
| Unskilled labor | manday | 2. |
| Unskilled labour for investments | manday | 2. |

183. For all tradable outputs and inputs, border prices have been calculated by adding or deducting the corresponding export taxes or import duties (see Table 23).

184. In the case of Other Costs of the Project items, border prices have been calculated for the imported goods (i.e. jeeps for extensionists, office equipment, etc.) which amount to 35% of the total costs of this item; while market prices have been adopted for local personnel services (65% of total cost of this item).

185. For all items converted in border prices (expressed in the local currency), the **SCF= SER/OER=1.2** has been applied in order to reflect the real social cost of foreign exchange.

186. All these items might "produce" or "consume" foreign exchange currency, by definition (tradable goods). Foreign exchange currency must be valued at its real cost for society therefore applying **SCF= SER/OER= 1.2**.[61]

[61] The operation can be easily seen as follows: (a) every item is transformed into foreign currency (i.e. USD) by applying the Official exchange rate to the price in local currency; (b) once we have the "border price expressed in USD" it should be converted again to the domestic currency "to assess its real social cost" by applying the SER. This is the same as if we multiply every item by the ratio SER/OER= 1.2

**Table 23: Elimination of market distortions**

Guideland
Rural Development Project
**BORDER PRICES**
(In $)

| | Unit | |
|---|---|---|
| **Outputs** | | |
| Cassava | kg | 0.1248 |
| Banana | kg | 0.312 |
| Maize | kg | 0.234 |
| Coffee | kg | 1.9656 |
| **Inputs** | | |
| **Planting Material** | | |
| Maize seed | plant | 0.3409 |
| Cassava cuttings | plant | 0.8636 |
| Banana suckers | plant | 0.0273 |
| Coffee seeding | plant | 0.1818 |
| **Purchased inputs** | | |
| Fertilizer | kg | 0.1496 |
| Chemicals | kg | 3.4 |
| Sacks | sack | 0.272 |
| Land preparation | unit | 90 |
| Equipment | unit | 1,758.5 |

187. The results are the "economic prices" of the tradable goods included in the project:

**Table 24: Conversion into economic prices**

Guideland
Rural Development Project
**ECONOMIC PRICES**
(In $)

| | Unit | |
|---|---|---|
| **Outputs** | | |
| Cassava | kg | 0.15 |
| Banana | kg | 0.375 |
| Maize | kg | 0.2813 |
| Coffee | kg | 2.3625 |
| **Inputs** | | |
| **Planting Material** | | |
| Maize seed | plant | 0.3409 |
| Cassava cuttings | plant | 0.8636 |
| Banana suckers | plant | 0.0273 |
| Coffee seeding | plant | 0.1818 |
| **Purchased inputs** | | |
| Fertilizer | kg | 0.1782 |
| Chemicals | kg | 4.05 |
| Sacks | sack | 0.324 |
| Land preparation | unit | 90 |
| Equipment | unit | 2110.2 |
| **Labor** | | |
| Unskilled labor | manday | 1.4 |
| Unskilled labour for investments | manday | 1.4 |

188. In addition, to all project inputs and outputs, “Other Costs” of the Project should also be converted into economic prices. The analysis of these costs shows that 35% of total costs (i.e. $ 2.06 million) are imported goods and 65% (i.e. $ 3.82 million) are local goods and services.

189. Therefore, the imported goods must be converted into economic prices by means of the following calculation: (a) market prices are multiplied by =0.909 in order to deduct VAT; (b) these prices (market prices without VAT) are multiplied by 0.75 in order to discount the import taxes of 25%; (c) the result is the border price (i.e. $ 0.68175 for a market price equivalent to $1) expressed in local currency which must be divided by the OER (1.15) and multiplied by the SER (1.38) to obtain the economic price of the imported good in local currency= 0.81. The Conversion Factor (economic price/ market price) for imported goods is equivalent to 0.81.

190. The total amount of imported goods under the “Other Costs of the Project” is multiplied by the CF and the “economic price “of imported goods is obtained: i.e. $ 1.67 million. Local goods must be valued without VAT and the result is the equivalent to $ 3.47 million. Adding both converted items the total amount of “Other Costs” in economic prices is equivalent to $ 5.14 million.

191. Last, the SDR has been set at 7% for this example.

192. With these elements it is now possible to correct the Financial Analysis of the Project “as a whole” and complete the Economic Analysis of the Project reaching the following results (See Table 25):

*(4) Economic profitability indicators should be calculated in order to assess the economic feasibility of the project.*

193. After the consideration of externalities, the correction of price/wage distortions and the choice of an appropriate social discount rate, it has been possible to calculate the *Guideland Project*’s economic performance using the following indicators (See Table 25):

**- Economic net present value (ENPV): $ 34 036 980**

- **Economic internal rate of return (EIRR): 20.7%**

- **B/C ratio: 2.68**

194. The ENPV is the most important and reliable social CBA indicator and should be used as the main reference economic performance signal for project appraisal.[62]

[62] Although ERR and B/C are meaningful because they are independent of the project size, they may sometimes involve problems. In particular cases, for example, the ERR may be multiple or not defined, while the B/C ratio may be affected by considering a given flow as either a benefit or a cost reduction. On the contrary, there might be cases where the use of the benefit-cost ratio is appropriate, for example under the capital budget constraints.

195. In principle, every project with an EIRR lower than the social discount rate or a negative ENPV should be rejected: a project with a negative economic return, uses too much of socially valuable resources to achieve too modest benefits for all citizens.

196. The *Guideland Project* obtained economic indicators prove the economic feasibility (i.e. the convenience for the society "as a whole") of the proposed rural investment project. **ENPV is positive at the given SDR (7%) and this is consistent with an ERR of 20.7 % > 7%.**

197. 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. for biodiversity preservation projects, cultural heritage sites, landscape). This should be seen as a rare occurrence, and the appraisal report should still specify in a convincing way, through a structured argument, sustained by adequate data, that, social benefits exceed social costs, even if the analyst is unable to fully quantify the former (See Section VI for more details on these cases).

198. It is interesting to compare the results obtained in the Financial Analysis and the Economic Analysis:

(a) FNPV= $ 20 418 610 and ENPV= $ 34 036 980
(b) FRR= 16.1% and ERR= 20.7%

199. The Economic profitability indicators are "higher" than those corresponding to the Financial profitability.

200. What could be the economic meaning of these results? First, they prove that, for the "economy as a whole", the project is more valuable than from a "private point of view". 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 "real economic value" of the outputs is higher than its 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 to explain the differences between the financial and economic performance indicators.

## Table 25a: Economic Analysis of the whole project – WOP/WP

Guideland
Rural Development Project

Crop year

| ECONOMIC BUDGET (AGGREGATED) (In $ '000) | Without Project | With Project | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 to 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 to 20 |
| **Main Production** | | | | | | | | | | | | | | | |
| Cassava | 1,050.0 | 1,050.0 | 1,068.8 | 1,125.0 | 1,200.0 | 1,275.0 | 1,331.3 | 1,350.0 | 1,350.0 | 1,350.0 | 1,350.0 | 1,350.0 | 1,350.0 | 1,350.0 | 1,350.0 |
| Banana | 6,750.0 | 6,750.0 | 6,796.9 | 6,421.9 | 6,843.8 | 9,187.5 | 11,015.6 | 11,578.1 | 11,906.3 | 12,000.0 | 12,000.0 | 12,000.0 | 12,000.0 | 12,000.0 | 12,000.0 |
| Maize | 478.1 | 485.2 | 639.8 | 942.2 | 1,110.9 | 1,125.0 | 1,125.0 | 1,125.0 | 1,125.0 | 1,125.0 | 1,125.0 | 1,125.0 | 1,125.0 | 1,125.0 | 1,125.0 |
| Coffee | 9,450.0 | 9,450.0 | 8,977.5 | 7,560.0 | 5,197.5 | 3,366.6 | 4,075.3 | 6,969.4 | 10,158.8 | 12,048.8 | 12,993.8 | 13,879.7 | 14,588.4 | 15,001.9 | 15,120.0 |
| **Sub-total Main Production** | 17,728.1 | 17,735.2 | 17,483.0 | 16,049.1 | 14,352.2 | 14,954.1 | 17,547.2 | 21,022.5 | 24,540.0 | 26,523.8 | 27,468.8 | 28,354.7 | 29,063.4 | 29,476.9 | 29,595.0 |
| **Production Cost** | | | | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | | |
| Cuttings and suckers | - | 4.8 | 14.3 | 23.9 | 23.9 | 9.5 | - | - | - | - | - | - | - | - | - |
| Planting Material | - | - | 159.1 | 495.4 | 868.1 | 940.8 | 500.0 | 127.3 | 36.4 | - | - | - | - | - | - |
| Purchased inputs | - | 2.1 | 24.2 | 81.9 | 171.0 | 235.9 | 213.8 | 124.7 | 35.6 | - | - | - | - | - | - |
| Land preparation | - | - | 45.0 | 135.0 | 225.0 | 225.0 | 90.0 | - | - | - | - | - | - | - | - |
| Equipment | - | - | 461.9 | 1,332.8 | 1,540.1 | 929.5 | 260.3 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | - | 6.9 | 704.5 | 2,068.9 | 2,828.1 | 2,340.7 | 1,064.0 | 252.0 | 72.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | | | | |
| Unskilled labour for investments | - | 3.5 | 43.4 | 127.4 | 221.2 | 244.3 | 149.8 | 50.4 | 11.2 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | - | 10.4 | 747.9 | 2,196.3 | 3,049.3 | 2,585.0 | 1,213.8 | 302.4 | 83.2 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | | |
| Planting Material | 11.9 | 11.9 | 14.9 | 20.9 | 23.9 | 23.9 | 23.9 | 23.9 | 23.9 | 23.9 | 23.9 | 23.9 | 23.9 | 23.9 | 23.9 |
| Cuttings and suckers | 12.6 | 12.6 | 13.6 | 15.6 | 18.8 | 23.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 |
| Purchased inputs | 43.1 | 48.6 | 71.5 | 109.7 | 157.1 | 218.5 | 284.5 | 350.7 | 405.8 | 426.1 | 426.1 | 426.1 | 426.1 | 426.1 | 426.1 |
| **Sub-Total Purchased Inputs** | 67.7 | 73.2 | 100.0 | 146.2 | 199.8 | 265.3 | 333.4 | 399.6 | 454.7 | 474.9 | 474.9 | 474.9 | 474.9 | 474.9 | 474.9 |
| **Labor** | | | | | | | | | | | | | | | |
| Unskilled labor | 1,180.2 | 1,183.7 | 1,196.7 | 1,188.3 | 1,156.4 | 1,180.9 | 1,278.2 | 1,421.7 | 1,561.0 | 1,615.6 | 1,615.6 | 1,615.6 | 1,615.6 | 1,615.6 | 1,615.6 |
| **Sub-total Operating Costs** | 1,247.9 | 1,256.9 | 1,296.7 | 1,334.4 | 1,356.2 | 1,446.2 | 1,611.6 | 1,821.3 | 2,015.7 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 |
| **Sub-Total Production Cost** | 1,247.9 | 1,267.3 | 2,044.6 | 3,530.8 | 4,405.4 | 4,031.3 | 2,825.4 | 2,123.7 | 2,098.9 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 |
| **Other Costs** | | | | | | | | | | | | | | | |
| Other Costs | - | 499.1 | 751.4 | 837.2 | 1,252.4 | 1,004.6 | 591.3 | 206.1 | - | - | - | - | - | - | - |
| **OUTFLOWS** | 1,247.9 | 1,766.4 | 2,796.0 | 4,368.0 | 5,657.8 | 5,035.9 | 3,416.7 | 2,329.8 | 2,098.9 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 | 2,090.5 |
| **Cash Flow** | 16,480.3 | 15,968.8 | 14,687.0 | 11,681.1 | 8,694.3 | 9,918.2 | 14,130.5 | 18,692.7 | 22,441.1 | 24,433.2 | 25,378.2 | 26,264.2 | 26,972.9 | 27,386.4 | 27,504.5 |

## Table 25b: Economic Analysis of the whole project – INCREMENTS

Guideland
Rural Development Project

| ECONOMIC BUDGET (AGGREGATED) (In $ '000) | Increments | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 to 20 |
| **Main Production** | | | | | | | | | | | | | | |
| Cassava | - | 18.8 | 75.0 | 150.0 | 225.0 | 281.3 | 300.0 | 300.0 | 300.0 | 300.0 | 300.0 | 300.0 | 300.0 | 300.0 |
| Banana | - | 46.9 | -328.1 | 93.8 | 2,437.5 | 4,265.6 | 4,828.1 | 5,156.3 | 5,250.0 | 5,250.0 | 5,250.0 | 5,250.0 | 5,250.0 | 5,250.0 |
| Maize | 7.0 | 161.7 | 464.1 | 632.8 | 646.9 | 646.9 | 646.9 | 646.9 | 646.9 | 646.9 | 646.9 | 646.9 | 646.9 | 646.9 |
| Coffee | - | -472.5 | -1,890.0 | -4,252.5 | -6,083.4 | -5,374.7 | -2,480.6 | 708.8 | 2,598.8 | 3,543.8 | 4,429.7 | 5,138.4 | 5,551.9 | 5,670.0 |
| **Sub-total Main Production** | 7.0 | -245.2 | -1,679.1 | -3,375.9 | -2,774.1 | -180.9 | 3,294.4 | 6,811.9 | 8,795.6 | 9,740.6 | 10,626.6 | 11,335.3 | 11,748.8 | 11,866.9 |
| **Production Cost** | | | | | | | | | | | | | | |
| **Investment** | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | |
| Cuttings and suckers | 4.8 | 14.3 | 23.9 | 23.9 | 9.5 | - | - | - | - | - | - | - | - | - |
| Planting Material | - | 159.1 | 495.4 | 868.1 | 940.8 | 500.0 | 127.3 | 36.4 | - | - | - | - | - | - |
| Purchased inputs | 2.1 | 24.2 | 81.9 | 171.0 | 235.9 | 213.8 | 124.7 | 35.6 | - | - | - | - | - | - |
| Land preparation | - | 45.0 | 135.0 | 225.0 | 225.0 | 90.0 | - | - | - | - | - | - | - | - |
| Equipment | - | 461.9 | 1,332.8 | 1,540.1 | 929.5 | 260.3 | - | - | - | - | - | - | - | - |
| **Sub-Total Purchased Inputs** | 6.9 | 704.5 | 2,068.9 | 2,828.1 | 2,340.7 | 1,064.0 | 252.0 | 72.0 | - | - | - | - | - | - |
| **Labor** | | | | | | | | | | | | | | |
| Unskilled labour for investments | 3.5 | 43.4 | 127.4 | 221.2 | 244.3 | 149.8 | 50.4 | 11.2 | - | - | - | - | - | - |
| **Sub-total Investment Costs** | 10.4 | 747.9 | 2,196.3 | 3,049.3 | 2,585.0 | 1,213.8 | 302.4 | 83.2 | - | - | - | - | - | - |
| **Operating** | | | | | | | | | | | | | | |
| **Purchased Inputs** | | | | | | | | | | | | | | |
| Planting Material | - | 3.0 | 8.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 |
| Cuttings and suckers | - | 1.0 | 3.0 | 6.2 | 10.3 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 |
| Purchased inputs | 5.5 | 28.4 | 66.6 | 114.0 | 175.4 | 241.4 | 307.6 | 362.7 | 383.0 | 383.0 | 383.0 | 383.0 | 383.0 | 383.0 |
| **Sub-Total Purchased Inputs** | 5.5 | 32.4 | 78.5 | 132.1 | 197.7 | 265.7 | 331.9 | 387.0 | 407.3 | 407.3 | 407.3 | 407.3 | 407.3 | 407.3 |
| **Labor** | | | | | | | | | | | | | | |
| Unskilled labor | 3.5 | 16.5 | 8.1 | -23.8 | 0.7 | 98.0 | 241.5 | 380.8 | 435.4 | 435.4 | 435.4 | 435.4 | 435.4 | 435.4 |
| **Sub-total Operating Costs** | 9.0 | 48.8 | 86.6 | 108.3 | 198.4 | 363.7 | 573.4 | 767.8 | 842.7 | 842.7 | 842.7 | 842.7 | 842.7 | 842.7 |
| **Sub-Total Production Cost** | 19.4 | 796.7 | 2,282.9 | 3,157.6 | 2,783.4 | 1,577.6 | 875.8 | 851.0 | 842.7 | 842.7 | 842.7 | 842.7 | 842.7 | 842.7 |
| **Other Costs** | | | | | | | | | | | | | | |
| Other Costs | 499.1 | 751.4 | 837.2 | 1,252.4 | 1,004.6 | 591.3 | 206.1 | - | - | - | - | - | - | - |
| **OUTFLOWS** | 518.5 | 1,548.1 | 3,120.1 | 4,410.0 | 3,788.0 | 2,168.9 | 1,081.9 | 851.0 | 842.7 | 842.7 | 842.7 | 842.7 | 842.7 | 842.7 |
| **Cash Flow** | -511.5 | -1,793.3 | -4,799.2 | -7,785.9 | -6,562.1 | -2,349.8 | 2,212.4 | 5,960.9 | 7,953.0 | 8,898.0 | 9,783.9 | 10,492.7 | 10,906.1 | 11,024.2 |

IRR = 20.7%, NPV = 34,036.98

### *Risk and sensitivity analysis*

*(5) Sensitivity analysis should be undertaken taking into account reasonable variations in the expected costs and benefits. This analysis would provide the basis for a proper risk assessment of the projects and the inclusion of mitigation measures.*

201. The economic analysis of projects is by definition based on uncertain future events. The estimation of the basic elements in the cost and benefit streams of projects, such as input and output prices and quantities, inevitably involves explicit or implicit probability judgments..

202.

203. In order to deal with this crucial issue, there are some techniques that help to detect the "critical variables" or sources of major risks and set the basis for introducing mitigating measures that might moderate their impact.

204. The most common tool used is the "**Sensitivity Analysis**". Sensitivity analysis allows for the identification of the "critical variables" or parameters and quantifies the extent of their influence. Such variables are those whose variations, positive or negative, have the greatest impact on a project's financial and/or economic performance. The analysis is carried out by testing the fluctuation of one element at a time and determining the effect of that change on IRR or NPV.

205. In practical terms, standard variations of 10%, 20% and 30% on benefits and costs, as well as 1 or 2 years delays in project implementation (with impacts in benefits and costs) are tested to assess their influence on project economic performance indicators (ENPV; EIRR).

206. One important aspect of the analysis of these results is the fact that by linking them with identified project risks, it provides grounded information to design effective and efficient mitigation measures. Each risk category should have a proxy to be tested in the sensitivity analysis ( > costs, < benefits) in order to use this information to make decisions on the design and budget allocation of mitigation measures.

207. For example, if one risk identified is the possibility of political disruption, the proxy to be tested is a delay in implementation; or the high probability of the introduction of import taxes, can be reflected in the increases of input costs; etc.. By observing to what extent these events will change the profitability indicators, project designer can easily identify the "critical risks".

**Table 26: Risk Analysis Matrix linked with Sensitivity Analysis**

| | Risk description | Probability of occurrence | Mitigation measure | Proxy to be compared with SA results: (i) increment in Costs; (ii) Decreases in benefits or (iii) Delay in |
|---|---|---|---|---|
| Institutional risks | | | | |
| Market risks | | | | |
| Policy risks | | | | |
| Other risks | | | | |

208. The **Sensitivity Analysis of the *Guideland Project*** shows the following results:

**Table 27: *Guideland Project*: Sensitivity analysis**

| Indicator | ERR | ENPV |
|---|---|---|
| **Base results** | 20.7% | 34055 |
| **Benefits reduction** | | |
| -10% | 20.4% | 30252 |
| -20% | 19.9% | 26448 |
| -30% | 19.4% | 22644 |
| **Costs increases** | | |
| *Other Costs* | | |
| 15% | 18.4% | 27840 |
| 30% | 17.7% | 26510 |
| *Investment Costs* | | |
| 15% | 19% | 29125 |
| 30% | 18.3% | 27482 |
| *Operating costs* | | |
| 15% | 20% | 33262 |
| 30% | 20.2% | 32469 |
| **Delays in benefits** | | |
| 2 years | 17.0% | 27208 |
| 3 years | 15.5% | 24116 |

209. The Project is a robust one in the sense that its main economic profitability indicators do not change significantly after changes in the expected benefits or costs. The more sensible variable seems to be the delays in the perception of gross benefits but the EIRR remains very high when compared with the SDR=7%.

210. The "**switching value**" indicator also serves to the purpose of detecting the **most critical variables**.

211. The switching value of a variable provides the % change in cost or benefits in order for the NPV of the project to become zero, or more generally, for the outcome of the project to fall below the minimum level of acceptability. The use of switching values in sensitivity analysis allows analysts to make some judgments on the risks of the project and the opportunity of undertaking risk-preventing actions.

212. For the *Guideland Project*, the obtained "switching values" are as follows:

**Table 28:** Switching values

| Guideland<br>Rural Development Project<br>SUMMARY SWITCHING VALUES | **Percent Change** |
|---|---|
| **Switching values at 7%** | |
| Incremental inflows | -95% |
| **Incremental outflows** | |
| Investment costs | >500% |
| Operating costs | >500% |
| Other Costs | >500% |
| **Total outflows** | 235% |

213. The review of these results confirms the robustness of the project. The probability of a 95% decrease in expected benefits is very low. The necessary increases in the different costs items to reach critical values are so high that their likelihood is practically nil.

# *Annex to Section IV and V: Practical advises*

## *Summary of Steps to a complete Economic and Financial Analysis*

### A. Financial analysis

(1) Identifying the benefits and the costs of the project: formulate farm models describing the existing farming systems (WOP) and the expected ones (WP).

(2) Comparing the flows of benefits and costs and calculate the differences between the two scenario in order to get the **incremental net benefits** of each farm or activity model;

(3) Calculate the indicators of financial profitability of each farm or activity model (financial net present value, financial rate of return and B/C ratio), applying the investment criteria to make the investment decision (positive or negative).

(4) Complement the above calculations with the "**financial sustainability analysis**", considering net family incomes. This information should demonstrate that individual HH incomes in the WP scenario effectively improve the present poverty situation and that incremental costs and labour requirements are not a burden for the beneficiaries. When this is not the case the projects need to identify other sources and type of financing mechanisms.

(5) Aggregate the whole project clearly describing **when** and **how many** people will engage in each activity/model, being realistic when phasing expected benefits to be produced by each intervention. Present through an "**incorporation matrix**". This matrix should be developed throughout a collective process including all mission members. Calculate Financial profitability indicators for the whole project.

### B. Economic analysis:

This analysis looks at a project from the perspective of the "society" and measures the effects of the project on the economy as a whole. Thus, it will require to take into consideration different items when looking at the costs of a project, valuate them differently and in some cases, even use different rates to discount the streams of costs and benefits. The analysis will then consider:

(6) **externalities** are taken into account and given a monetary value;

(7) cancellation of **transfer payments** (taxes and subsidies);

(8) observed prices or public tariffs are converted into **shadow prices**, that better reflect the social

opportunity cost of the good;

(9) costs and benefits are discounted with a **social rate of discount**;

(10) economic performance indicators are calculated: economic net present value (ENPV), economic rate of return (ERR) and the benefit-cost (B/C) ratio.

(11) Risk assessed through a sensitivity or switching values analysis: the SA test for adverse changes in project costs, benefits and delays in implementation identifying "critical variables" or sources of major risks.

***Common issues in economic analysis of IFAD projects***

The review of more than 100 projects approved by IFAD in the last two years concluded that the following are the most frequent errors in economic analysis:

- **Omissions of externalities**

Very few projects (if any) have identified and/or quantified positive or negative externalities. Classical examples of externalities in economic literature come from agricultural production (i.e. bee-keepers and fruit planters; water uses and downstream effects, etc.). Nevertheless, practically no IFAD project has 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).

- **Omissions of economic benefits of infrastructure and social components**

Many IFAD projects have infrastructure components (i.e. rural roads, storage, etc.) as well as social-oriented components (i.e. water facilities; sanitary improvements, etc.). However, very few projects have identified economic benefits related to theses investments. This is a clear under-estimation of economic benefits for the Projects.

- **Phasing and methodologies for the aggregation of net incremental benefits and beneficiaries**

Many projects have shown conceptual and calculation errors when aggregating net economic benefits of numerous farms and rural micro-enterprises. They include incorrect calculation of the incremental flows (i.e. many projects make the confusion between the "with project" situation and the "incremental situation"), lack of clear information on the "matrix of incorporation" of beneficiaries, duplication of flows, incorrect allocation of data, etc.

- **Double counting of costs**

Many projects present "farm budgets" that include amortization amounts as well as the investments. This is a typical conceptual confusion of "accounting" rules and "financial analysis" criteria.

More important, many projects, when formulating the economic analysis, include two times the aggregated costs of the incremental investments and input costs. Actually, the typical error consists of including "all project costs" (extracted from COSTAB) in the outflows while 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 the market wages without major justifications. Very few projects adjust the market prices of trade and tradable goods. Practically there are no presentations 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 with identified risks of the project. In addition, almost all sensitivity analysis do not include the calculation of "switching values" and therefore, there are no clear identification of the most critical variables of the project.

### *Presentation issues: Tables to be included in the EFA documents*

| **Inputs for financial analysis**<br><br>**(WOP and WP situations)** | **Information to be included** | **Where to be included** |
|---|---|---|
| Crop Budgets and Models | - In technical coefficients and units.<br><br>- In monetary terms (financial prices of outputs and inputs) | Include in WP. |
| Activity Models & Budgets | - In technical coefficients and units.<br><br>- In monetary terms (financial prices of outputs and inputs) | Include in WP. |
| Farm Models & Budgets<br><br>(rural micro-enterprises models if needed) | - In technical coefficients and units.<br><br>- In monetary terms (financial prices of outputs and inputs).<br><br>- Cash flow (y0 to T20) and phasing of benefits | Include in Annex 10 and WP. |
| **Farm/Activity Models Summary results**<br><br>(rural micro-enterprises budgets if needed) | - WOP/WP and incremental scenarios<br><br>-Indicators of financial profitability (IRR/NPV)<br><br>- List of assumptions and justification of the financial rate of discount; Other indicators: net incomes in the with project situation vs. income poverty line; returns to labor; returns to land, etc. | ***Include summary results in PDR***. Full information in Annex 10 and in WP. |
| **Inputs for Economic Analysis** | **Presentation** | **Remarks** |
| Matrix of beneficiaries incorporation | -Per farm/activity model and by year | ***Include in PDR***; in Annex 10 and WP (full phasing) |
| List of Shadow Prices | - Clear identification of indirect taxes and subsidies. Correction of financial prices.<br><br>-For Tradable and Non tradable goods;<br><br>-Labor;<br><br>- Foreign Exchange;<br><br>-Social Rate of discount<br><br>Figures and sound economic justification for each one. | Include in Annex 10 and WP (full information) |
| List of Economic Prices | Show calculations of economic prices : conversion of financial prices by means of the shadow prices. | Include summary in PDR and Annex 10. Full information in WP. |
| Aggregation of net incremental economic benefits | - Complete table of Project Economic Analysis<br><br>- Economic Profitability Indicators (i.e. ENPV; ERR) | ***Include summary table in PDR***; full table in Annex 10 and WP |
| Sensitivity Analysis | - Variations in Costs and Benefits (10%; 15%; 30%).<br><br>- Short paragraph linking SA with risk analysis<br><br>- Switching values. Identification of the most critical variables. | ***Include summary table and risk analysis in PDR*** and Annex 10. Full table in WP. |

***Checklist for the revision of EFA documents***

| **Documents Checklist** | **Y/N** | **Remarks** |
|---|---|---|
| PDR | | Mandatory |
| Project cost and Annexes | | Mandatory |
| E&F analysis Annexes | | Requirement for IFAD's project necessary for submission to QA |
| WP on E&F and Project Costs<br>Production Models in Excel Tables , FARMOD and COSTAB | | When key information is not reflected in PDR or Annexes :<br>Only necessary to check models or *bizarre* data |

| **Project Costing** | **Y/N** | **Remarks** |
|---|---|---|
| Project costs and financial sources | | Are all project costs duly taken into consideration? (i.e. pay attention to "working capital", training activities; etc.)<br>Are co-donors 'components included in the analysis?<br>Are beneficiaries contributions accounted? Check beneficiaries' contribution to productive assets, if any.<br>Grants: flow of funds to see what are they financing? |
| Project components and spending | | Are spending well distributed/ linked w Logframe?<br>Are there linkages between the COSTAB tables and the activities/component?<br>Are expenditures categories linked with budget lines? |
| Specific spending | | Are maintenance cost included and expenditures on capital reposition taken into consideration?<br>% of project management costs? Balance between productive investment and project management costs. |
| Nr beneficiaries/ Ha | | Linked with indicators in logframe and adoption rates used in the E&F analysis |

| E&F analysis Checklist | Y/N | Remarks |
|---|---|---|
| Financial and Economic analysis | | IRR and EIRR? NPV? Are adopted Discount Rates reflecting the opportunity cost of capital? Poor countries (national) > than non-poor countries who have access to international capital markets |
| assumptions | | Are assumptions realistic (check inflation, prices, etc..) |
| Farm models | | Clear assumptions and technical models. With and without project situation presented to calculate net incremental benefits |
| Crop model | | Nr of ha in model correspond with model description |
| Cash flow analysis | | Include returns to labour and land in addition to capital calculations |
| Net incremental Benefits | | Cash flow analysis shows NIB at farmer level?<br><br>Project's impact on poverty line (USD2/day=730USD)?<br><br>Family labour is not imposing a too heavy load at HH level?<br><br>In value-chain projects: verify NIB at different levels of v.c. |
| Beneficiaries incorporation | | Incorporation Matrix shows incorporation streams?<br><br>Check with assumptions in adoption/uptake rates |
| Aggregated model | | Clear aggregation methodology |
| Project costs | | Check *double counting* of costs: the project costs should be net from resources transferred to the farm models *via* grants or credit.<br><br>PC different from COSTAB = Price contingencies, taxes and duties, credit component discounted |
| Model aggregation | | Does total amount of ha/beneficiaries correspond with project description? |
| Economic analysis | | Is the investment efficient for the economy as a whole? |
| Shadow prices | | Adjust financial prices to reflect the economic prices of resources. Check assumptions. Check wages, elimination of transfer payments, taxes, input costs, export and import goods, etc..<br><br>Are Foreign Exchange markets competitive? Are there foreign exchange controls? If this is the case, the SCF should not be equal to 1. SCF is an indicator of the "foreign exchange shadow rate", therefore, SCF should be > 1 and it should be applied to all tradable goods and services in the project flows.<br><br>Is the unemployment rate above 7 %? If this is the case, the "shadow salaries" should be lower than the "market or legal salaries" fo the economic analysis. How much? : It depends on the level of the unemployment rate. SCF on W should be < 1<br><br>In the case of "qualified manpower" (i.e. professionals, technicians, etc), the opposite occur: scarcity of qualified manpower would imply a "shadow salary" higher than the market ones. SCFW>1 |

| E&F analysis Checklist | Y/N | Remarks |
|---|---|---|
| Justifications | | Are justifications realistic and explain application of SCF? |
| Un-quantified benefits | | Are efforts made to take them into consideration?<br><br>Are cost efficiency analysis possible? |
| - Water<br>- Environment<br>- Rural infrastructure<br>- Social infrastructure<br>- Food security<br>- Education<br>- Health<br>- Savings in post-harvest losses | | Simple methodologies to measure the impact/ benefits from improved uses of water, rural infrastructure, environment externalities, savings from reduced post-harvest losses; etc..<br><br>Include in flow of Econ NIB.<br><br>At least describe un-quantified benefits. |
| Risk analysis/sensitivity analysis | | Linked with sensitivity analysis. Each risk category should have a proxy to be tested in the sensitivity analysis ( > costs, < benefits).<br><br>Is this information used to take decisions on how to allocate budget and design mitigation measures?<br><br>***Typical mistakes:***<br><br>(a) When rising Cost: only project cost should be touched not all the rest.<br>(b) When reducing benefits: only brut incremental benefits should be touched.<br>(c) In cases where periodical natural cycles are present ( floods, droughts, etc..) the sensitivity analysis should account for drops in benefits every X years and recalculate the IRR. |

## MISSING PRESENTATION Advises:

- **General index for Annex 10 of PDR**
- **We need to keep the spread sheets of the whole EFA, including ALL crop and farm models.**

***Summary of how to quantify Benefits from specific project's components[63]***

| Project components | Quantifiable benefits |
|---|---|
| **Rural infrastructure**: Storage facilities, Irrigation | ➢ Post-harvest losses reduction<br>➢ Increased value of the final product due to investments in storage and cooling facilities, or small scaling processing (like drying or conserving)<br>➢ Increases in product and productivity thanks to water provision |
| **Value chain**: collective marketing; warehouse receipt systems; increased market information | ➢ Increased value of the final product thanks to increased access to markets<br>➢ Creation of internal and external markets that did not exist before investments<br>➢ Distribution of value added among the main actors of the VC |
| **Rural Roads**: | ➢ Reduction in transportation costs and in vehicle maintenance costs (VOC-TTC)<br>➢ Increased volume of transported agricultural products for sale<br>➢ Post-harvest losses reduction due to better access to sale points |
| **Domestic Water Supply** | ➢ Time saved from not having to carry water from the original source<br>➢ Reduction in sickness through consumption of better water quality<br>➢ Reduced water losses due to leakages<br>➢ Increased productivity through small plots crop irrigation and through the provision of water for livestock<br>➢ Backyard gardening |
| **Rural finance** | ➢ Efficiency gains in the financial system can lower operation costs and ensure self-sufficiency and sustainability of financial services supply.<br>➢ Shifts in the portfolio composition of the FIs (productive loans versus consumption)<br>➢ Incremental taxation revenues to the government<br>➢ Potential productivity increases through financing of the working capital. (incremental benefits to the clients/borrowers)<br>➢ Economic benefits from transfer effects |
| **NRM practices** (changes in tillage practices, crop rotations, land/soil conversion, afforestation, energy efficient systems, 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<br>➢ Increasing crop, timber and livestock yields through soil preservation, conservation tillage and agriculture<br>➢ Increased final product value thanks to labelling as Organic Agricultural practices<br>➢ Avoiding rehabilitation costs of public infrastructure destroyed by natural disasters<br>➢ Energy saving thanks to replacement of old practices by eco-friendly artefacts (eco-stoves, solar panels, etc…). |
| **Land registration** | Land tenure security may translate into an increased land value explained by:<br>➢ Long term Investments for land fertility<br>➢ Improve access to credit as land can be used as a collateral guarantee for credit<br>➢ Greater dynamism of land markets.<br>➢ Environmental benefits as a result of better NRM (people improve or maintain forest and/or tree cover) |
| All projects have the additional benefit of employment generation (farm and off-farm) | |
| All project generate a multiplier effect on the economy as a whole as rural poor increases their income or access to credit, allowing for incremental consumption. | |

[63] See IFAD examples on section V of the IG

## *V. Complementary methods to identify and valuate benefits for Project Economic Analysis:*

214. IFAD´s Project and Portfolio Management System classification, sorts projects according to the relative weight of the different components on the total project costs. Out of 114 projects reviewed by QE between 2009 and 2011, 73% are agricultural or rural development-related while 16% core objective was to strengthening financial services. The rest had a specific focus on capacity building and NRM.

215. These data show that most IFAD's projects are designed to have a direct impact on increases and improvements in productivity. The typical rural development project has a mix of components addressing, on the one hand, direct support to agriculture and livestock through activities such as distribution and promotion of new seeds and fertilizers, complemented by rural infrastructure such as irrigation facilities, farmyards construction; storage or cooling facilities, and processing structures. The costs and benefits of these activities are generally easy to quantify and the EFA can be performed through a classic cost benefit analysis (CBA).

216. On the other hand, these activities will generally be accompanied with a set of components whose effects are not directly reflected in increases of production but which indirectly result in productivity increases and other type of social and economic benefits. These benefits are generally more difficult to be quantified, hence are usually **omitted from a standard CBA.**

217. Typical examples are activities reinforcing the development of value chains such as facilitating access to market; providing technical assistance; strengthening farmers' organizations in order to promote PPP or other types of marketing strategies. Other cases in which socio-economic benefits from project's activities are generally not included in the CBA include the following type of interventions: a) construction or rehabilitation of **rural roads** in remote areas; b) component aiming at improving the use of **natural resources** (i.e. soil preservation); promoting energy friendly technologies (i.e. solar panels, eco-stoves, etc..), as well as specific activities on carbon sequestration; c) activities related to domestic **water management** and **sanitation**. All the above are part of the most common IFAD supported projects and therefore their benefits are important to be considered, quantified and assessed.

218. The following sections have the objective of providing a set of practical guidelines and examples on how to quantify these "intangible" benefits to be included in a standard CBA through the formulation of reliable assumptions. The section does not pretend to cover all possible cases but to provide useful examples on how this could be done building on IFAD and other IFIs financed projects. This is work under progress and all additional examples as well as comments are welcome.

### *Rural infrastructure projects:*

219. Almost a third of total IFAD projects reviewed by QE between 2009 and 2011, center their development activities around the establishment and/or rehabilitation of rural infrastructure (see table below for some examples).

220. Some of these rural infrastructure projects such as **irrigation facilities** are likely to produce immediate increases in productivity and quality of production that are generally reflected in the with and without project scenarios presented in the farm models on which the CBA is based. Other type of infrastructure might not directly affect productivity but will possibly avoid losses in volumes of production such as post-harvest, storage and cooling facilities.

221. There are also infrastructures which will contribute to increase the value of the final product as well as facilitate access to markets due to investments in storage, packaging and cooling facilities, or small scaling processing (like drying or conserving).

222. Lastly, rural infrastructure such as roads, domestic water provision or sanitation will not directly affect volumes or value of produced crops, but will ameliorate rural community's social and economic welfare as well as reduce transport costs, reduce time dedicated to trips to the market and to fetch up water. In this way, additional time will be available for other activities, as well as a sensible reduction in sickness in the household thanks to the access to better quality of water and sanitation infrastructure.

**Table 1: Common types of IFAD Rural Infrastructure interventions:**

| | |
|---|---|
| **Support to production** | |
| Irrigation | Drip irrigation, gravity irrigation systems, terraces, small dam constructions/rehabilitation |
| Storage Infrastructure | Cold storage facilities for fish, storage drums for maize, cereal banks, dairy storage facilities |
| Post-harvest handling | Threshing, shelling, cleaning, sorting, grading, packaging, pack houses, good practice centres |
| Drying | Use of tarpaulins, drying cribs |
| Processing Technology | Village level dairy processing, cassava processing, local equipment fabrication |
| **Collective Marketing / Value Chain interventions** | |
| Warehouse Receipt System | Storage, quality assurance, inventory |
| Capacity Building/Training | Farmer field schools, farm shows, good agricultural practices, quality control |
| Institutional/Policy Development | Formation of farmer groups, engagement of the private sector, processors, contracts |
| Market Information | Cellular networks (Tradenet), internet, learning tours, trade fairs, market studies, market spies |
| **Transport Infrastructure** | |
| Rural roads | Rural access roads , rural connecting roads |
| Other commercial transport | Bridges; ports and peers rehabilitation |
| **Access to sanitary and domestic water** | |
| Domestic water provision | Rain Roof water harvesting (RRWH); domestic tanks; water wells |
| Sanitation facilities | Latrines; septic tanks and waste water treatment |
| **Access to finance** | |
| Rural Financial Services | Credit to support e.g. equipment acquisition<br>Change of regulations and policies;<br>Support to development of finance institutions<br>Support to different financial institutions such as credit unions, community/rural banks, commercial banks;<br>Support to formal and informal groups |

Source: Review of post-harvest systems in IFAD programmes (IFAD draft 2012)

223. An increasing number of IFAD projects are incorporating post-harvest related activities. About 53% of the new and on-going projects i.e. loans that became effective between 2008 and 2011, incorporate post-harvest related interventions; a significant increase from 29% when projects between 2000 and 2010 are considered. The increase is partly due to the fact that more projects are adopting a value chain approach (projects including value chains support activities have increased from 3% in 1999 to more than 46% in 2012)64 (see example on how to measure benefits from post-harvest handling schemes in annex 1, table 1)

224. Generally, between 30% and 50 % of fruits and vegetables are lost due to weak and poorly post-harvest infrastructures. Losses are highest at pre- and post-harvest stages in developing countries underscoring the need to focus on packaging solutions and concomitant farm to market support infrastructures required at these stages of the value chain. This is in great contrast to the industrialized countries where losses are at their peak at the retail and consumption stages (FAO Food loss reduction strategy, 2011)

**Case study: Timor Leste Drums for Maize project 2011**

225. The key intervention proposed under the Timor Leste Drums for Maize project is the provision of about 42,000 drums (average of 1.8 drums per target household) that will be imported and distributed over the course of Phase I. Phase I will also actively research the possibility of manufacturing a suitable alternative to imported drums, with the aim of developing this local supply capacity under a possible future Phase II.

226. The primary **benefit stream was based on valuing reduced storage losses associated with the use of the approximately 42,000 drums** which will be procured and distributed under the Project. A secondary benefit stream has also been estimated based on farmers increasing their storage capacity by an additional 50% through the purchase of additional drums from market channels following the distribution of 1-2 subsidized drums by the Project. Including both primary and secondary benefit streams, the Project has the capacity to generate an ERR of 13%. Excluding the secondary benefit stream, the ERR drops to 12%. These results justify the Project's investments assuming a 10% opportunity cost of capital over a 20-year period.

[64] From "Review of Post-Harvest Systems in IFAD Projects and Programmes", IFAD Draft, January 2012.

## Table 1 : Post harvest losses reduction: Timor-Leste: Drums for Maize

| | Units | Unit cost | PY 1 | PY 2 | PY 3 | PY 4 | PY 5 | PY 6 | PY 7 | PY 8 | PY 9 | PY 10 | PY 11 | PY 12 | PY 13 | PY 14-20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY DISTRIBUTION THROUGH PROJECT** | | | | | | | | | | | | | | | | |
| **200L drums distributed by project** | **drums** | | 8 190 | 12 295 | 21 756 | | | | | | | | | | | |
| **Cumulative distribution** | **drums** | | 8 190 | 20 484 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 | 42 241 |
| **Total storage capacity** | **MT** | | 1 474 | 3 687 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 | 7 603 |
| **Storage losses WOP /1** | **MT** | **12.0%** | 177 | 442 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 |
| **Storage losses WP** | **MT** | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Net reduction in storage losses** | **MT** | | 177 | 442 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 | 912 |
| **Economic benefit of reduced losses /2** | **USD** | **556** | 98 353 | 246 007 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 |
| **SECONDARY DISTRIBUTION /3** | | | | | | | | | | | | | | | | |
| **Additional 200L drums purchased by farmers** | **drums** | | | | | 2 112 | 2 112 | 2 112 | 2 112 | 2 112 | 2 112 | 2 112 | 2 112 | 2 112 | 2 112 | |
| **Cumulative purchases** | **drums** | | | | | 2 112 | 4 224 | 6 336 | 8 448 | 10 560 | 12 672 | 14 784 | 16 896 | 19 008 | 21 120 | 21 120 |
| **Total storage capacity** | **MT** | | | | | 380 | 760 | 1 140 | 1 521 | 1 901 | 2 281 | 2 661 | 3 041 | 3 421 | 3 802 | 3 802 |
| **Storage losses WOP** | **MT** | **12.0%** | | | | 46 | 91 | 137 | 182 | 228 | 274 | 319 | 365 | 411 | 456 | 456 |
| **Storage losses WP** | **MT** | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Net reduction in storage losses** | **MT** | | | | | 46 | 91 | 137 | 182 | 228 | 274 | 319 | 365 | 411 | 456 | 456 |
| **Economic benefit of reduced losses** | **USD** | **556** | | | | 25 365 | 50 729 | 76 094 | 101 459 | 126 823 | 152 188 | 177 553 | 202 918 | 228 282 | 253 647 | 253 647 |
| **Financial cost of additional drums** | **drums** | **55** | | | | 116 162 | 116 162 | 116 162 | 116 162 | 116 162 | 116 162 | 116 162 | 116 162 | 116 162 | 116 162 | 0 |
| **Economic cost of additional drums** | **SCF=** | **95%** | | | | 110 354 | 110 354 | 110 354 | 110 354 | 110 354 | 110 354 | 110 354 | 110 354 | 110 354 | 110 354 | 0 |
| **Net economic benefit** | | | | | | -84 989 | -59 624 | -34 260 | -8 895 | 16 470 | 41 834 | 67 199 | 92 564 | 117 928 | 143 293 | 253 647 |
| **PROJECT COSTS** | | | | | | | | | | | | | | | | |
| **Total financial costs excl R&D only** | | | 1 197 259 | 1 316 902 | 1 830 432 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total economic costs excl R&D only** | **SCF=** | **95%** | 1 137 396 | 1 251 057 | 1 738 910 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **TOTAL NET ECONOMIC BENEFIT** | | | | | | | | | | | | | | | | |
| **(1) Excl secondary distribution benefits** | **EIRR=** | **12%** | -1 039 044 | -1 005 049 | -1 231 616 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 | 507 294 |
| **(2) Incl secondary distribution benefits** | **EIRR=** | **13%** | -1 039 044 | -1 005 049 | -1 231 616 | 422 305 | 447 669 | 473 034 | 498 399 | 523 764 | 549 128 | 574 493 | 599 858 | 625 222 | 650 587 | 760 941 |

***Footnotes:***

***1/ Estimated at 12% cumulative weight loss under traditional storage methods.***
***2/ Import parity price for rice, calculated at farmgate. TL is currently importing large qtys of rice to cover national food deficits, with only very small qtys of maize imported for manufactured products.***

***3/ Initial drum supply is sufficient to cover a relatively small portion of storage needs. Given the robust financial viability of improved storage, farmers are assumed to purchase an additional 1 drum following the initial distribution. Phase 2 of the project will support private sector capacity to meet this demand, possibly through local manufacture.***

### *Value chain projects:*

227. Value chains operate with a large diversity of models. A fundamental objective of IFAD supported value chain projects is the creation of linkages between farmers and private sector processors, traders and financial institutions. For IFAD to reach the target groups throughout this interventions is an important challenge, as poor rural smallholders are not an obvious choice for inclusion in value chains. Nevertheless, there is also evidence available that for certain commodities small producers can be included in value chains, especially under the out grower models.

228. Performing an EFA of a value chain is challenging as many aspects of the interaction throughout the value change needs to be analyzed. On the one side, the single financial viability of each stakeholder participating in the value chain may be assessed through a standard CBA, however the most interesting analysis would be to assess: (i) how the value added is distributed along the chain and (ii) where the bottle necks that impede a fair and competitive distribution of benefits are. This analysis, in addition to require collecting information from the field during the mission (which might be very costly and time demanding) would face the problem that private companies are usually reluctant to disclose their financial information (**see table 2**). Other aspects on how the development of the value chain are benefitting local economies are interesting to analyze such as the creation of internal and external markets that did not exist before as a result of value chain investments (**see table 3**)

**<u>Case study</u>: The Fisheries Investment Project (FIP) in Yemen 2010 and Armenia 2010: Value chain investment**

229. Fisheries Investment Project (FIP) in Yemen 2010 aims at improving the sustainability of fisheries resource management. This will be achieved through stimulating the growth and technological improvement of the fisheries value chains and rural business activities, including aquaculture.

230. FIP interventions to increase the profitability of small scale fishing operations include:

- installation of cold storage facilities on board and training sufficient and efficient use of ice;
- financing of mother ships which will provide support at sea to groups of smaller vessels including provisioning with food and fuel, and better storage of fish;
- financing of transport vessels for remote fishers' communities;
- construction of integrated landing sites with modern auction facilities, ice plants and cold storage;
- export promotion and support for certification.

231. At the boat level owner, captain and crew will benefit from higher fish prices achieved as a result of training in improved fish handling and installation of ice boxes on board. They will also benefit from improvements to safety-at-sea, insurance in case of accidents and reduced costs if they adopt the mother boat system. Construction of integrated landing sites will improve integrity of the cold chain, improve handling and hygiene of fish and provide a safe, sheltered location to moor boats. Knowledge of fisheries resources will be improved, as will their management and the capacity of the MFW to enforce regulations. In the long term this will result in improved health of fish stocks and reduced risk of overexploitation.

232. Hereafter we present an estimation of the distribution of value added among the main actors of the value chain in three different fishing areas (Gulf of Aden, Socotra and Red Sea). **The last scales on the value chain take the most share of the net profit** (traders-exporters take in average more than 50% of the net profit in all the fishing regions).

**Table 2: Value Chain Actors Net Profit Margins (% and millions of tons), Fisheries Investment Project, Yemen (3 fishing regions: Gulf of Aden, Socotra and Red Sea).**

| Value chain actors | | Before upgrading | | After upgrading | |
|---|---|---|---|---|---|
| | | Net profit Margins % | Net profit in mT | Net profit Margins % | Net profit in mT |
| Gulf of Aden | Boat owner | 16 | 52,732 | 16 | 76812 |
| | Total Crew share | 31 | 105,464 | 29 | 139240 |
| | Traders-exporters | 53 | 178,247 | | |
| | Processor/exporter | | | 55 | 260461 |
| | Total | 100 | 336,442 | 100 | 476513 |
| Socotra | Boat owner | 6 | 27882 | 11 | 49100 |
| | Total Crew share | 13 | 61142 | 22 | 98201 |
| | Transport ship | 38 | 182422 | | |
| | Trader-exporter | 44 | 210655 | | |
| | Processor/exporter | | | 68 | 307818 |
| | Total | 100 | 482101 | 100 | 455119 |
| Red Sea | Boat owner | 15 | 53626 | 12 | 60247 |
| | Total crew share | 17 | 62489 | 13 | 70174 |
| | Wakeel | | | | |
| | Cooperative | | | 5 | 26591 |
| | Traders-exporters | 68 | 248956 | | |
| | Processors/exporters | | | 70 | 363785 |
| | Total | 100 | 365071 | 100 | 520796 |

Source: Mission estimates

**Table 3: Armenia 2010: Value chain investment allow for the creation of internal and external markets that did not exist before**

**YIELDS AND INPUTS**

| **Items** | Unit | Price AMD | Without Project | With Project | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10-20 |
| **Main Production** | | | | | | | | | | | | | |
| Local sale | kg | 150 | 0 | 0 | 0 | 400 | 1 600 | 4 000 | 4 000 | 4 000 | 4 000 | 4 000 | 4 000 |
| Export sale | kg | 347 | 0 | 0 | 0 | 1 600 | 6 400 | 16 000 | 16 000 | 16 000 | 16 000 | 16 000 | 16 000 |
| **Sub-total** | | | 0 | 0 | 0 | 2 000 | 8 000 | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 | 20 000 |
| **Investment Inputs** | | | | | | | | | | | | | |
| Machinery | ha | 244 475 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Drip-fertigation | ha | 1 155 000 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Poles | item | 1 348 | 0 | 400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wires | kg | 3 465 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Planting (holes, water, pipe for protection) | ha | 192 500 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Part of communal water supply | ha | 231 000 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Operating Inputs** | | | | | | | | | | | | | |
| Fertiliser (350kg/ha) | kg | 123 | 0 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 |
| Plant protection | ha | 61 600 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Water (drip irrigation) | m3 | 10.010 | 0 | 7 000 | 7 000 | 7 000 | 7 000 | 7 000 | 7 000 | 7 000 | 7 000 | 7 000 | 7 000 |
| Drip irrigation O&M | ha | 96 250 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Land Tax | ha | 35 000 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Boxes | 10 kg | 1 348 | 0 | 0 | 0 | 200 | 800 | 2 000 | 2 000 | 2 000 | 2 000 | 2 000 | 2 000 |
| Transportation (150 km) | ton-km | 46 | 0 | 0 | 0 | 300 | 1 200 | 3 000 | 3 000 | 3 000 | 3 000 | 3 000 | 3 000 |
| ***Labour*** | | | 0 | | | | | | | | | | |
| Farm Labour | person-day | 2 500 | 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

**Financial Budget( AMD)**

| Items | Without Project | With Project | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10-20 |
| **Revenue** | | | | | | | | | | | |
| Local sale | 0 | 0 | 0 | 60 060 | 240 240 | 600 600 | 600 600 | 600 600 | 600 600 | 600 600 | 600 600 |
| Export sale | 0 | 0 | 0 | 554 400 | 2 217 600 | 5 544 000 | 5 544 000 | 5 544 000 | 5 544 000 | 5 544 000 | 5 544 000 |
| ***Sub-total Revenue*** | 0 | 0 | 0 | 614 460 | 2 457 840 | 6 144 600 | 6 144 600 | 6 144 600 | 6 144 600 | 6 144 600 | 6 144 600 |
| **Investment Inputs** | | | | | | | | | | | |
| Machinery | 0 | 244 475 | | | | | | | | | |
| Drip-fertigation | 0 | 1 155 000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Poles | 0 | 539 000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wires | 0 | 69 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Planting (holes, water, pipe for protection) | 0 | 192 500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Part of communal water supply | 0 | 231 000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Subtotal Investment Costs*** | 0 | ***2 431 275*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Operating Inputs** | | | | | | | | | | | |
| Fertiliser (350kg/ha) | 0 | 43 120 | 43 120 | 43 120 | 43 120 | 43 120 | 43 120 | 43 120 | 43 120 | 43 120 | 43 120 |
| Plant protection | 0 | 61 600 | 61 600 | 61 600 | 61 600 | 61 600 | 61 600 | 61 600 | 61 600 | 61 600 | 61 600 |
| Water (drip irrigation) | 0 | 70 070 | 70 070 | 70 070 | 70 070 | 70 070 | 70 070 | 70 070 | 70 070 | 70 070 | 70 070 |
| Drip irrigation O&M | 0 | 48 125 | 96 250 | 96 250 | 96 250 | 96 250 | 96 250 | 96 250 | 96 250 | 96 250 | 96 250 |
| Land Tax | 0 | 0 | 0 | 0 | 0 | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 | 35 000 |
| Farm labour | 0 | 24 998 | 24 998 | 24 998 | 24 998 | 24 998 | 24 998 | 24 998 | 24 998 | 24 998 | 24 998 |
| Boxes | 0 | 0 | 0 | 269 500 | 1 078 000 | 2 695 000 | 2 695 000 | 2 695 000 | 2 695 000 | 2 695 000 | 2 695 000 |
| Transportation (150 km) | 0 | 0 | 0 | 13 860 | 55 440 | 138 600 | 138 600 | 138 600 | 138 600 | 138 600 | 138 600 |
| ***Subtotal Operating Costs*** | 0 | 247 913 | 296 038 | 579 398 | 1 429 478 | 3 164 638 | 3 164 638 | 3 164 638 | 3 164 638 | 3 164 638 | 3 164 638 |
| **Total Cost** | 0 | 2 679 188 | 296 038 | 579 398 | 1 429 478 | 3 164 638 | 3 164 638 | 3 164 638 | 3 164 638 | 3 164 638 | 3 164 638 |
| **Gross Income** | 0 | -2 679 188 | -296 038 | 35 062 | 1 028 362 | 2 979 962 | 2 979 962 | 2 979 962 | 2 979 962 | 2 979 962 | 2 979 962 |
| **Incremental Gross Income (before financing)** | | -2 679 188 | -296 038 | 35 062 | 1 028 362 | 2 979 962 | 2 979 962 | 2 979 962 | 2 979 962 | 2 979 962 | 2 979 962 |
| NPV @10% (AMD) | 6 912 940 | | | | | | | | | | |
| IRR | 39% | | | | | | | | | | |
| Benefit/Cost Ration | | | | 1.1 | 1.7 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |

### *Rural roads*

233. Rural road projects generally aim to improve basic connectivity and accessibility from villages to markets and social services. This is normally achieved through the construction and/or rehabilitation of main/regional roads and/or connecting/village roads. All rural roads are expected to yield not only savings in vehicle operating cost (VOCS)65 and road- user travel time cost (TTC)66, but also broadened socio-economic opportunities for the rural population in the form of increased access to education, health and market services.

234. In order to assess these benefits it is crucial to have data on actual traffic as well as expected increases volumes in traffic which is the key difference between the two types of roads above mentioned.

A. In roads where **traffic flow is significant** (main or regional roads), or where we have the means to measure it, we can estimate expected benefits in VOC and TTC for both passenger and freight traffic by multiplying the incremental volume by the unit price reduction. For these cases, in order to calculate road infrastructure construction costs as well as assess operation and maintenance costs, the World Bank has developed two tools: ROCKS and RONET[67] (**See diagram 1**)
B. In rural isolated areas, where IFAD usually operates, and particularly for unpaved roads **where traffic levels are very low** (between 50 and 500 vehicles per day) **or unknown/not measurable,** it is impossible to calculate VOC or TTC benefits using traffic data. However, some IFAD cases have shown that benefits from road improvements can be estimated considering certain ranges for parameters such as:
    - **Reduction in transportation costs** and in **vehicle maintenance costs** can vary from 5 to 20% according to different IFAD projects analyses[68]
    - **Increased volume of transported agricultural products** for sale can range between 10% and 40%

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[65] VOCS (Vehicle Operating Costs Savings): Five cost components associated with operating a vehicle are fuel and oil consumption, maintenance and repairs, tire wear and roadway related vehicle depreciation. The equations used to estimate vehicle consumption have been developed from a number of major studies. Variables such as fuel consumption and time speeds are easily measured by tests. Other variable such as tire wear and vehicle maintenance require tedious and long-term observations under a variety of road conditions. Consequently the methods for determining VOC consumption are based on a mixture of survey work, mechanistic modeling and statistic analysis. (from *Road User and Mitigation Costs in Highway Pavement Projects*, by David Leonard Lewis. US National Research Council).

[66] TTC (Road-user Travel Time Cost): Time spent traveling in a vehicle has a cost. If no economic value is attached to time savings, most road improvements cannot be justified either in social or economic terms (from *Road User and Mitigation Costs in Highway Pavement Projects*, by David Leonard Lewis. US National Research Council). It is measured by multiplying the time delay by the total travel time costs/min.

[67] ROCKS is a World Bank's tool to calculate road infrastructure costs. Download at:

http://go.worldbank.org/ZF1I4CJNX0.

RONET is a tool to estimate the budget needs and assess performance of road maintenance Download at: http://go.worldbank.org/A2QQYZNFM0

[68]. Armenia 2010: Rural Assets Creation programme, Tanzania 2010: Marketing, Infrastructure, Value Addition and rural finance support programme:

- **Post-harvest losses reduction** due to a better access to the sale points may range between 10% and 50% depending on the type of commodity and remoteness of the area (i.e. reduction losses will be greater among perishable products such as vegetables than of crops).

235. **Estimation of benefits of rural road from VOCS (Vehicle Operating Costs Savings) for both passengers and freight traffic:**

236. Daily freight and passengers with and without project are generated on the basis of the likely population growth and the freight transportation increase. These figures, together with the average economic unit VOCs for freight and passengers, are used to estimate the project's costs and benefit, taking account of the following:

237. -road investment is assumed to take one year, so that there is a one-year lag between costs and the first benefits. O&M costs start in the year following construction;

238. - VOC savings for freight are based on the without project freight volume, i.e. the average saving per ton/km multiplied by the total numbers of ton/km shipped without project;

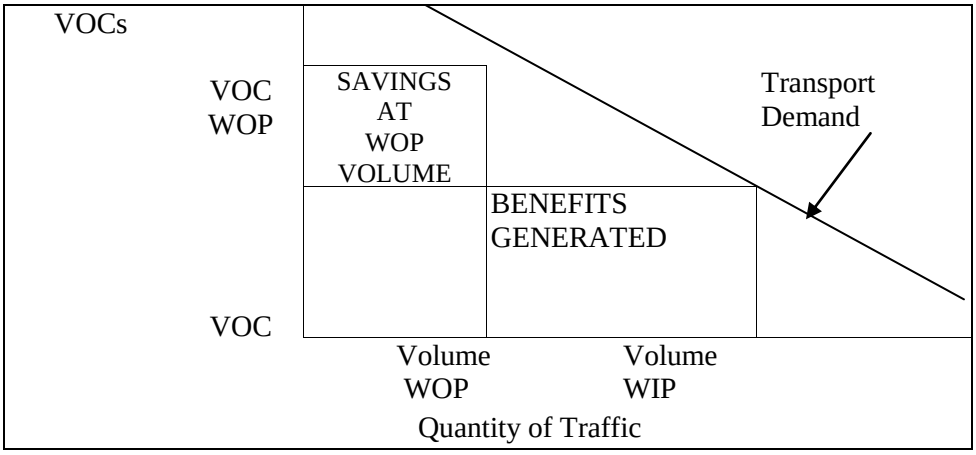
239. -VOC savings for passengers are calculated similarly, i.e. the volume of passenger traffic without project multiplied by the average saving per passenger/km;

240. Generated benefits for both freight[69] and passengers[70] as can be seen from the diagram - is the area between the transport demand curve and the with project VOC over the range from the WOP (without project) volume to the WIP (with project) volume. With a 'straight line' demand curve, this area is a triangle with an area of 50% of the incremental volume multiplied by the unit price reduction; this approximation is used to estimate Generated Benefits for both passenger and freight traffic.

[69] Freight transported: as a result of both better roads and improved yields stemming from other project factors, agricultural freight transported along the road would increase to 60%; and non-agricultural freight, would pass from 0.6kg/day on very bad gravel roads to 2.0kg/day on good gravel roads.

[70] Passenger traffic with and without project is deduced based on assumed growth in population and on an increase of the number of trips per day per capita (passing from 0.08 to 0.12), resulting from the change in road conditions.

**Diagram 1**




Note: WOP= Without project; WIP= With project

241. In the following IFAD projects in Armenia, Tanzania and Bangladesh, solid assumptions are made to estimate the benefits of rural roads:

**<u>Case studies:</u> Armenia 2010 - Rural Assets Creation programme:**

242. The model in this case analyses the rehabilitation of a village road of about 7 km which serves three villages connecting them to a main road and sites where all main agricultural activities are concentrated. As a result of improved access, it is assumed that the transportation unit cost per ton-km would be decreased by 15%, while the volume of tradable agricultural products would double. Annual costs for road operation and maintenance are assumed to be 1.5% of the investment costs **(See table 4**)

## Table 4: Rehabilitation of a Village Road (7 km) serving 3 Villages (Rural Assets creation programme. Armenia 2010)

(constant 2009 values)
Length of the road - 7 km, rehabilitation costs are USD 760 000.
The road connects 3 beneficiary villages with the main district road.
The benefits would be derived from increased volume of transported agricultural products for sale and reduced operation and maintenance costs of vehicles

| Description | Beneficiary Villages | Average per hh | Yield, t/ha |
|---|---|---|---|
| Population, number | 2250 | | |
| Households, number | 700 | 3.21 | |
| Orchards (nuts) | 100 | 0.14 | 5 |
| Orchards (peaches) | 100 | 0.14 | 20 |
| Cereals | 1100 | 1.57 | 2.1 |
| Sub-total cultivated land, ha | 1300 | 1.86 | |
| **Agricultural production** | **Volume, ton** | **Price, AMD/kg** | **Value, AMD'000** |
| Orchards (nuts) | 500 | 770 | 385 000 |
| Orchards (peaches) | 2000 | 150 | 300 300 |
| Cereals | 2310 | 100 | 231 000 |
| Total | 4810 | | 916 300 |
| **Parameters** | **Unit** | **WOP** | **WP** |
| Population served | no | 2 250 | 2 250 |
| No of rural HHs served | no | 700 | 700 |
| Cultivated area served | ha | 1 300 | 1 300 |
| Total volume of production | ton | 4 810 | 4 810 |
| Total value of production | AMD'000 | 916 300 | 916 300 |
| Total volume of sales | ton | 962 | 1 924 |
| Average journey | km | 10 | 10 |
| Total transportation | ton-km | 9 620 | 19 240 |
| Total value of sales | AMD'000 | 183 260 | 366 520 |
| Net income from sales | AMD'000 | 54 978 | 109 956 |
| Incremental net income from sale | AMD'000 | | 54 978 | 100% |
| Transportation costs, truck | AMD/ton*km | 46 | 39.3 | 15% |
| Volume of transportation by truck | ton-km | 9 620 | 19 240 |
| Total transportation costs by truc | AMD'000 | 444 | 756 |
| Total transportation costs | AMD'000 | 444 | 756 |
| Incremental transportation costs | AMD'000 | | 311 |

**Financial budget, AMD'000**

| | PY 1 | PY 2 | PY 3 | PY 4 | PY 5 | PY 6 | PY 7 | PY 8 | PY 9 | PY 10 | PY 11 | PY 12 | PY 13 | PY 14 | PY 15 | PY 16 | PY 17 | PY 18 | PY 19 | PY 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Incremental net revenue | 16 493 | 27 489 | 41 234 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 | 54 978 |
| NPV @ 10% (AMD'000) | 400 028 | | | | | | | | | | | | | | | | | | | |
| Investment costs | | | | | | | | | | | | | | | | | | | | |
| Road rehabilitation, AMD'000 | 292 600 | | | | | | | | | | | | | | | | | | | |
| NPV @ 10% (AMD'000) | 266 000 | | | | | | | | | | | | | | | | | | | |
| Recurrent Costs | | | | | | | | | | | | | | | | | | | | |
| Operation and maintenance /a | | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 | 4 389 |
| Incremental transportation costs | 156 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 | 311 |
| Sub-total recurrent costs | 156 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 |
| NPV @ 10% (AMD'000) | 35 883 | | | | | | | | | | | | | | | | | | | |
| Total Incremental Costs | 292 756 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 | 4 700 |
| Net benefit | (276 262) | 22 789 | 36 533 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 | 50 278 |
| **IRR** | **15.1%** | | | | | | | | | | | | | | | | | | | |
| **NPV @ 10% (AMD'000)** | **98 145** | | | | | | | | | | | | | | | | | | | |

a/ 1,5 % of the investment costs for road rehabilitation

| Switching Values | Appraisal Value | Switching Value | % Change |
|---|---|---|---|
| Incremental Revenues (inflows) | 400 028 | 301 883 | -25% |
| Incremental Recurrent Costs | 35 883 | 134 028 | 274% |
| Incremental Investments | 266 000 | 364 145 | 37% |
| Incremental Outflows | 301 883 | 400 028 | 33% |

**Tanzania 2010: Marketing, Infrastructure, Value Addition and rural finance support programme: benefits from roads rehabilitation are expected from:**

- -new products transported, valued at 3, 3 million USD;
- -post-harvest loss reduction: valued at 10% of post-harvest potential losses;
- -transport cost reduction: valued at 10% of transport costs (**See below**).

**Table 5: Marketing, Infrastructure, Value Addition and rural finance support programme**

| | | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 | Y9 | Y10-19 | Y20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New Road Rehabilitation (km) /a** | | 0 | 165 | 413 | 567 | 505 | | | | | | |
| **Cumulative Road Rehabilitation (km) /a** | | 0 | 165 | 578 | 1,145 | 1,650 | 1,650 | 1,650 | 1,650 | 1,650 | 1,650 | 1,650 |
| **Economic Benefits (USD)** | | | | | | | | | | | | |
| Traffic increase | USD | 0 | 333,667 | 1,168,844 | 2,315,444 | 3,336,667 | 3,336,667 | 3,336,667 | 3,336,667 | 3,336,667 | 3,336,667 | 3,336,667 |
| Value of post-harvest loss reduction | USD | 0 | 166,833 | 584,422 | 1,157,722 | 1,668,333 | 1,668,333 | 1,668,333 | 1,668,333 | 1,668,333 | 1,668,333 | 1,668,333 |
| Reduction in transportation costs | | 0 | 16,683 | 58,442 | 115,772 | 166,833 | 166,833 | 166,833 | 166,833 | 166,833 | 166,833 | 166,833 |
| **Total benefits** | USD | **0** | **517,183** | **1,811,709** | **3,588,939** | **5,171,833** | **5,171,833** | **5,171,833** | **5,171,833** | **5,171,833** | **5,171,833** | **5,171,833** |

\a Year in which roads are fully operational. Including spot improvement and village access roads.

| **Assumptions** | **Unit** | |
|---|---|---|
| Roads rehabilitated | km | 1,650 |
| Roads per district | km | 45 |
| Number of districts | no. | 37 |
| Number of trips per truck/district | year | 52 |
| distance covered per trip | km | 90 |
| **Without programme** | | |
| Total number of trips on programme roads per year | no. | 1,907 |
| Volume transported per truck/trip | MT | 14 |
| Volume transported overall (without programme) | MT/year | 26,693 |
| Transportation costs | USD/MT | 50 |
| Average value of products | USD/MT | 500 |
| Value of products transported | USD | 13,346,667 |
| **With programme** | | |
| Increase in traffic | % | 25% |
| Volume transported by increased traffic | MT/year | 6,673 |
| Cost of transported products per year /b | USD | 1,668,333 |
| **Value of new products transported** | USD | **3,336,667** |
| **Value of post-harvest loss reduction (10%) /c** | USD | **1,668,333** |
| **Value of transport cost reduction (10%)** | USD | **166,833** |
| **Total incremental benefits at full implementation /d** | USD | **5,171,833** |

\b existing and new transports.

\c based on the forecasted reduction due to: new markets, training on PHL reduction and marketing.

\d PY5.

**<u>Case study</u>: Hoar, Bangladesh 2011: Infrastructure and livelihood improvement project:**

243. In this case, to value the incremental benefits from the rehabilitation of a community road of 4 km connecting few villages to the same road, it was assumed that transportation costs per ton-km would decrease by 19%, while the volume of tradable agricultural products would increase by 20%. Annual costs for road operation and maintenance are estimated to be 5% of the investment costs starting from Year 3 (**See table 6**).

244. Length of the road: 4 km. Rehabilitation unit cost is BDT (Bangladesh taka)

245. The road connects beneficiaries´ village with the main road district. The benefits would be derived from increased volume of transported products for sale and reduced transportation costs of vehicles. The number of economic beneficiaries per km per road is approximately 170.

| **Description** | **Beneficiary** | **Production (Ton/ ha)** | |
|---|---|---|---|
| Rice producers | 150 | 4,2 | |
| Vegetables producers | 20 | 0,8 | |
| Sub-total production | 170 | 5 | |
| Fishing production | Value, Ton | Price, BDT/Tonne | Value BDT |
| Rice production | 630 | 25.000 | 15.750.000 |
| Vegetables production | 16 | 75.000 | 1.200.000 |
| Total | 646 | | 16.950.000 |

**Situation with and without project (Bangladesh rehabilitation of rural road):**

| Parameter | Unit | WOP (Without Project) | WP (With Project) |
|---|---|---|---|
| Number of beneficiaries | Nb | 170 | 170 |
| Total volume of production | ton | 646 | 646 |
| Total value of production | BDT | 16.950.000 | 16.950.000 |
| Total volume of sales | ton | 162 | 194 |
| Average journey | km | 8 | 8 |
| Total transportation | ton/km | 1292 | 1550 |
| Total value of sales | BDT | 3.390.000 | 4.068.000 |
| Net income from sales | BDT | 1.356.000 | 1.749.240 |
| Incremental income from sales | BDT | - | 393.240 |
| Transportation costs, rickshaw van | BDT/ton/km | 3,2 | 2,7 |
| Volume of transportation by rickshaw van | ton/km | 1292 | 1550 |
| Total transportation costs by rickshaw | BDT | 4134 | 4186 |
| Total transportation costs | BDT | 4134 | 4186 |
| Incremental transportation costs | BDT | - | 52 |

**Financial budget of the Bangladesh rehabilitation of rural road project (units in Bangladesh taka =BDT)**

| | YP1 | YP2 | YP3 | YP4 |
|---|---|---|---|---|
| **Incremental Net revenue** | 78.648 | 117.972 | 196.620 | 314.592 |
| **Investment Costs. Road paving** | 1.520.000 | | | |
| **Recurrent costs: operation and maintenance (5% of the investment costs)** | | | 38.000 | 76.000 |
| **Incremental transportation costs** | 26 | 52 | 52 | 52 |
| **Subtotal recurrent costs** | 26 | 52 | 38.051 | 76.052 |
| **Total incremental costs** | 1.520.000 | 52 | 38.051 | 76.052 |
| **Net benefit** | 14.441.378 | 117.920 | 158.568 | 238.540 |

**IRR: 13,5%**
**NPV at 12 % :**
**128.757**

***Domestic Water management:***

246. Water management is the activity of planning, developing, distributing and managing the optimum use of water resources.

247. The most common interventions in IFAD's portfolio include alternatives to preserve, extract or harvest water for irrigation, as shown in table 1. In these cases, the feasibility of the intervention is analyzed by comparing the total investment costs of the irrigation infrastructure plus the operating cost against the value of the expected incremental production of targeted crops and livestock.

248. However, some other interventions do not aim at increasing production volumes but at increasing water for domestic uses. In these cases, investment costs required for the construction of proposed infrastructure such as water wells, canals, water tanks, roof rain water harvesting systems etc. are easily quantifiable, but their produced benefits are less tangible. The study of several IFAD project have shown that likely benefits might come from:

- **time saved** from not having to collect water from the original source
- **reduction in sickness** among household members given consumption of better water quality (**see T 8**)
- **reduced water losses** due to leakages, (**see table 7**: Rehabilitation of a Drinking Water Supply Scheme, Armenia 2010
- increased productivity through **small plots crop irrigation** and through the provision of **water for livestock** (in this case, the benefits could be added directly into the crop/livestock model); See annex, **table 9**: PRODESEC Project in Nicaragua, 2011, focused on the analysis of quantifiable benefits resulted from the installation of different water collection infrastructures (water tanks and small dams)
- **backyard gardening:** including vegetables, medical plants and fruits generally for auto consumption: (See annex, PRODESEC Project in Nicaragua2011)

**<u>Case study</u>: Rehabilitation of a Drinking Water Supply Scheme (Armenia 2010)**

249. The model analyses the benefits of investing in rural drinking water supply systems through rehabilitation of a main drinking water pipeline, internal network and a small pump station benefiting 200 households. The investment would provide safe and low cost water supply alternatives to the beneficiary households' present situation. The cost of this investment would be AMD 77 million (USD 200 000). The estimated annual operation and maintenance cost is AMD 1.16 million (about 1.5% of investment cost).

250. The main benefit would arise from:

- reduced water losses due to leakages (about 47 000 m3 annually) in the old system. The economic benefits of water saving are calculated by multiplying the saved volume by the cost of water.
- timesaving of one hour per day per household. The economic benefits per household are calculated by multiplying the daily timesaving and the opportunity cost of rural labour.

## Table 7: Rehabilitation of a Drinking Water Supply Scheme (Armenia 2010: Rural assets creation programme)

Construction of the main pipeline (3.2 km), rehabilitation of the internal network (3.4 km) and reconstruction of the pump station
Rehabilitation costs - USD 200 000
(constant 2009 values)

| **Estimated Returns to Rehabilitation Works** | | | **200 household** | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average time saved per day, hours/hh | 1 | | | | | | | | | | | | | | | | | | | | | |
| Time saved per year, days | 30 | | | | | | | | | | | | | | | | | | | | | |
| Opportunity cost of labour, AMD/pd | 2500 | | | | | | | | | | | | | | | | | | | | | |
| Financial Benefits, AMD'000/household | 76 | | | | | | | | | | | | | | | | | | | | | |
| Annual water losses, m3 | 47000 | | | | | | | | | | | | | | | | | | | | | |
| Water price, AMD/m3 | 25 | | | | | | | | | | | | | | | | | | | | | |
| Annual water losses, AMD'000 | 1175 | | | | | | | | | | | | | | | | | | | | | |
| | | Development year | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| **Incremental Benefits (AMD'000)** | | | | | | | | | | | | | | | | | | | | | | | |
| Time saving benefits | | | | | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 | 15 207 |
| Water saving benefits | | | | | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 | 1 175 |
| **Total Incremental Benefits** | | | | | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 |
| **Drinking Water Supply - Rehabilitation** | | | | | | | | | | | | | | | | | | | | | | | |
| | | Unit | | | | | | | | | | | | | | | | | | | | | |
| **Investment Costs** | | AMD'000 | 77 000 | 77 000 | | | | | | | | | | | | | | | | | | | |
| | | | Development year | | | | | | | | | | | | | | | | | | | | |
| **Financial Budget (MD'000)** | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Incremental Benefits | | | | | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 | 16 382 |
| | NPV @10% (AMD'000) | | 124 578 | | | | | | | | | | | | | | | | | | | | |
| Investment Costs | | | | 77 000 | | | | | | | | | | | | | | | | | | | |
| | NPV @10% (AMD'000) | | 70 000 | | | | | | | | | | | | | | | | | | | | |
| Incremental Operation and Maintenance Costs (1.5% of investment costs) | | | | | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 | 1 155 |
| | NPV @10% (AMD'000) | | 9 661 | | | | | | | | | | | | | | | | | | | | |
| **Total Net Benefits** | | | | -77 000 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 | 15 227 |
| | **IRR** | | **19%** | | | | | | | | | | | | | | | | | | | | |
| | **NPV @10% (AMD'000)** | | **45 794** | | | | | | | | | | | | | | | | | | | | |

Based on the costs provided by the engineers of the PAAU

| **Switching Values** | **Appraisal Value** | **Switching Value** | **% Change** |
|---|---|---|---|
| **Incremental net benefits (inflows)** | 124 578 | 78 783 | -37% |
| **Incremental Outflows** | | | |
| Investment Costs | 77 000 | 122 794 | 59% |
| Operating Costs | 9 661 | 55 456 | 474% |
| Total Outflows | 86 661 | 132 456 | 53% |

**Table 8: Case study: Community-Based Food Security and Economic Opportunities Programme - Soum Son Seun Jai, Lao 2011:**

In this project efforts were made to quantify benefits from time saved and reduction of sickness

| **Village Water Supply** | | | | |
|---|---|---|---|---|
| Assumptions: | | | | |
| No of families/village | 75 | | | |
| Economically active persons per family | 3 | | | |
| Economically Active persons | 225 | | | |
| Financial Wage Rate (LAK '000/day) | 30 | | | |
| Economic Unskilled Shadow Wage Rate (LAK '000/day) | 15 | | | |
| Two people per family save 20 minutes per day each from not having to carry water from original source. This implies standpipe is about 500 m closer to the house than the formerly used supply. With better quality water sickness is reduced by one week per worker per year | | | | |
| | hrs/day | no of people | Economic wage rate | savings/ year LAK '000 |
| Labour Costs saved | 0.333 | 150 | 15.00 | 34,185 |
| | | | | |
| | av days saved/yr | workers/ village | | |
| sick days/year saved | 5 | 225 | 15.00 | 16,875 |
| Total Annual savings | | | | **51,060** |
| | | | | |
| Initial Cost of System at financial prices. | 110,400 | | | |
| Economic conversion factor 1/ | 0.84 | | | |
| Economic Cost | 92,736 | | | |
| | | | | |
| **Calculation of Economic Rate of Return (ERR)** | | | | |
| | | | Y1 | Y2 -10 |
| Economic Investment Cost | | | - 92,736 | |
| Economic Cosy of Maintenance of system (5% p.a.) | | | | - 4,637 |
| Annual Economic Economic Benefits | | | | 51,060 |
| Net Economic Benefits - Base Case | | | - 92,736 | 46,423 |
| | | | | |
| **ERR - base case** | **49%** | | | |
| | | | | |
| Sensitivity | | | | |
| ERR - with time savings halved | 17% | | | |
| ERR - with shadow wage rate equal to actual wage rate | 99% | | | |
| | | | | |
| 1/ ECF based on Cost of Construction as follows | | | | |
| | | CF assumed | Weighted ECF | |
| Skilled labour | 10% | 1.00 | 0.10 | |
| Unskilled Labour | 10% | 0.50 | 0.05 | |
| Fuel | 20% | 0.60 | 0.12 | |
| Other Costs | 60% | 0.95 | 0.57 | |
| ECF Construction | | | **0.84** | |
| | | | | |
| ECF of maintenance is assumed to be the same, so economic cost is 5% of economic investment cost | | | | |
| | | | | |
| *Note: No account taken of benefits from vegetable irrigation using excess water.* | | | | |

### *Rain Roof Water Harvesting and small dams*

**Case study: PRODESEC Nicaragua**

251. In the PRODESEC project, several visits were organized to the project established infrastructures to validate assumptions used in the development of the financial and economic tool on roof rain water harvesting (RRWH) systems. Thanks to the direct interaction with PRODESEC beneficiaries, the model was reformulated to reflect realistic conditions responsible for the generation of costs and benefits produced by the investments in these type of systems.

252. Assumptions: The total construction costs for each tank is of 818 USD (218 USD of labour costs and 600USD materials: bricks, concrete, reinforced with steel top beam and a zinc foil-covered wooden structure). Beneficiaries' contribution to this total cost are of 7%. On top of the investment costs, recurrent cost including training on O&M account for another 200USD for the first year and 35 USD as maintenance cost for the rest of the depreciation period of each structure. TOTAL COST: 1018 USD

253. The benefits: Benefits have been defined as productive/agricultural and socio-economic benefits. The first category includes all benefits and savings resulting from increases in productivity thanks to the availability of water all year long. The second set of benefits are those indirect impacts on the living standards, such as time saved from collecting water, health improvements, etc..

254. In the without-project situation: families consume more water than they manage to collect (19 266 missing litres per year).

255. Two members of each family dedicate 3 hours per day collecting water every day of the year. These are the women and older children of the household.

256. As water is not sufficient very little is dedicated to productive activities. The water used in the kitchen is afterwards used to feed 5 chicks and one skinny cow who's health condition does not allow for reproduction, the rest of the water is used to irrigate a basic garden (tomatoes and chillies).

257. In the with-project situation: once the tank is installed, during the winter it fills up alone with rain falls all the time. Instead, during the summer, and because in this specific case, collective tanks provided are not very big (4m3), it is necessary for the family to collect water when it empties. During the summer this happens every 11 days and it needs to be re-filled in total 16 times in the summer. During this season, as the water stagnates, its quality is difficult to be ensured and is better used for productive ends and not for human consumption. Thus, the family still collects water once a day during the dry season.

258. The availability of water allows the family to increase their livestock (2 pigs, 10 chicks, 5 sheep or goats and 2 cows). In addition, small agriculture is now also possible giving available water for irrigation. The household now produces, in addition to the basic garden, also fruit trees (oranges, mango, avocado, sweet cane, etc...), bananas, yucca, spices, ornamental flowers and medicinal plants.

259. Another indirect benefit is the increased use of productive land. Without water, families tend to use only 0.6% of productive land, with the RRWH system this increases until a 11%, and potentially could reach almost 50% is any kind of irrigation system is installed

260. In terms of economic and social benefits, the household will now enjoy some higher sanity standards and experience reductions in sick days that are also been considered and quantified in the model (5 less sick days per year).

261. Please see next table for quantification of net incremental benefits:

**Table 9: Net incremental benefits (sales less costs with project and without project) from the installation of water harvesting infrastructures such as water tanks and small dams. PRODESEC project, Nicaragua 2011.**

| **Net Incremental Benefits**<br>*Financial prices in Cordobas* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Productive benefits*** | **Item** | **Price** | **Y1** | **Y2** | **Y3** | **Y4** | **Y5** | **Y6** | **Y7** | **Y8** | **Y9** | **Y10** |
| Improvements in animal production | - | - | 9655 | 34292 | 39959 | 46082 | 53188 | 53188 | 53188 | 53188 | 53188 | 53188 |
| Pigs | - | - | 794 | 7940 | 7940 | 7940 | 7940 | 7940 | 7940 | 7940 | 7940 | 7940 |
| Chicken | - | - | 6025 | 16569 | 19883 | 25004 | 30125 | 30125 | 30125 | 30125 | 30125 | 30125 |
| Ships and Goats | - | - | 994 | 2413 | 2555 | 2697 | 2839 | 2839 | 2839 | 2839 | 2839 | 2839 |
| Cows | - | - | 1843 | 7370 | 9581 | 10441 | 12284 | 12284 | 12284 | 12284 | 12284 | 12284 |
| Nutrition security improvements thanks to backyard gardening | - | - | 2340 | 3120 | 5460 | 7020 | 7800 | 7800 | 7800 | 7800 | 7800 | 7800 |
| Other benefits | - | - | 0 | 0 | 0 | 3742 | 4678 | 4678 | 4678 | 4678 | 4678 | 4678 |
| ***Subtotal net incremental productive benefits per year*** | - | - | ***11.995*** | ***37.412*** | ***45.419*** | ***56.844*** | ***65.666*** | ***65.666*** | ***65.666*** | ***65.666*** | ***65.666*** | ***65.666*** |
| ***Social benefits*** | | | | | | | | | | | | |
| Time saved per year per household | 83,4 | 100,0 | 8.336 | 8.336 | 8.336 | 8.336 | 8.336 | 8.336 | 8.336 | 8.336 | 8.336 | 8.336 |
| Health improvements (sick days saved thanks to better quality water) | 5 | 100,0 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Other social benefits | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Subtotal net incremental social benefits per year*** | | | ***8.836*** | ***8.836*** | ***8.836*** | ***8.836*** | ***8.836*** | ***8.836*** | ***8.836*** | ***8.836*** | ***8.836*** | ***8.836*** |
| ***Total Net Incremental Benefits*** | | | ***20.832*** | ***46.249*** | ***54.255*** | ***65.681*** | ***74.502*** | ***74.502*** | ***74.502*** | ***74.502*** | ***74.502*** | ***74.502*** |

### *Sanitation interventions:*

262. Basic sanitation refers to the management of human feces at the household level. Sanitation interventions include installation of latrines, septic tanks and waste water treatment. Improved hygiene and sanitation conditions in public places and tourist sites are important to attract more businesses and tourists. Besides, the absence of sanitary facilities affects people in terms of health and productivity in work and school.

263. The Water and Sanitation Program (WSP), a multi-donor partnership administered by the World Bank, conducted a quantitative and qualitative assessment of the impacts of poor sanitation on health, water quality and tourism in Cambodia, Indonesia, the Philippines, Vietnam, and Yunnan Province in China. The study71 was the first of its kind to attribute dollar amounts to a country's losses from poor sanitation. This study has estimated the cost-benefit ratio of pit latrines, shared latrines, septic tanks and sewerages in Cambodia, Indonesia, the Philippines, Vietnam, and Yunnan Province in China. In the Yunnan Province, **China, pit latrines in rural areas have an economic return of at least six times the cost.**

### *Rural finance projects:*

264. Access to financial services is crucial to enhance economic development and reducing poverty in rural areas. In fact, liquidity is essential to carry out the necessary investments to grow crops or feed livestock. Unfortunately, access to key financial services such as savings, credits and insurance, leasing and remittance facilities is generally scarce in rural areas of most developing countries. Little knowledge among service providers operating in rural areas and lack of products tailored to rural smallholder needs makes the availability of financial services in rural areas insufficient. Besides, rural smallholders face additional barriers to access credit services given the lack of collateral and lack of risk management mechanisms.

265. IFAD developments project often include a rural finance component which aims to enhance poor people access to a variety of financial services for both farm and off farm activities, including working and investment capital. Other type of IFAD interventions are focused on strengthening existing financial institutions so that they can better serve IFAD target group or promoting community savings schemes especially in the most marginalized areas. Matching grants have also been used to compensate for the absence of suitable term and investment finance and/or to stimulate investment and business activity where the intended beneficiaries operate under severe constraints. These

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[71] http://www.wsp.org/wsp/content/east-asia-economic-impacts-sanitation

In 2006 Lao PDR lost an equivalent to approximately 5.6% of GDP due to poor sanitation and hygiene. Of the impacts evaluated, health contributes 60% to the overall economic costs estimated in the study, followed by 18% for accessing clean drinking water, 13% for additional time to access unimproved sanitation, and 9% due to tourism losses. In Vietnam, the majority of economic losses due to poor sanitation (1, 3% of GDP) are shared between health (34%), water resources (37%), and the environment (15%). In 2006, Indonesia lost an estimated US$ 6.3 billion due to poor sanitation and hygiene, equivalent to approximately 2.3% of GDP. Of the impacts evaluated, health and water resources contribute most to the overall economic losses estimated in the study. Philippines in 2005, lost an equivalent 1, 5% of GDP: the health impacts represented the largest source of quantified economic costs at about US$ 1 billion, this item explained about 72% of total economic costs. In 2005 in Cambodia, poor sanitation leads to economic losses equivalent to 7.2% of the country's GDP, which is roughly equivalent to the contribution of the fishery sector to the GDP, or twice the forestry's contribution. Therefore, in this geographic area, sanitation infrastructures avoid production losses, that range between 1, 3% and 7, 2%, mainly due to improved health and productivity.

interventions should have as final goal to increase access to rural financial services to the rural poor and would therefore produce some economic benefits at that level. However the way of measuring and quantifying these effects is different in each case:

266. In the case where the aim is to guarantee access to investment capital for rural households, this should allow farmers to make investment decisions and ensure sustainability of those productive investments resulting in increases in both production and productivity. With the proper investment, it becomes easier to raise productivity. (See Belize rural finance project)

267. In the case where interventions aim specifically at improving the local financial institutions´ knowledge on how to better serve their rural clients, direct effects on increased productivity are more difficult to prove. In those cases where the flows of funds do not go directly to agriculture, the **minimum requirement** suggested in this note is at least to **identify the different stream of benefits** deriving from the project. Classical benefits could accrue at the following five levels:

(i) incremental benefits to the clients/borrowers,
(ii) incremental profits to the financial institutions targeted through the intervention (efficiency gains can lower operation costs and ensure self-sufficiency and sustainability of financial services supply),
(iii) shifts in the portfolio composition of the FIs (productive loans versus consumption),
(iv) incremental taxation revenues to the government and
(v) general impacts on the economy for policy, regulation and supervision.

268. However, capacity building of local financial institutions should certainly increase their sustainability in the long run, ensuring continuity for financing rural activities and therefore allowing farmers to plan future investments. This should somehow be translated in long term productivity effects. (See Tanzania case)

269. Following the Tanzania 2010 example, it is therefore possible (and advisable by this IG) to quantify and analyse the following:

- **Shifts in the portfolio composition** of the FIs (productive loans versus consumption). The comparison of the 'without project' portfolio mix with the 'with project ' mix can provide useful information on whether loans are better addressing demands from the agricultural sector and this impact on the economy.

- **Fiscal impacts**. All FIs will be subject to taxation schemes, therefore, an increase in their efficiency and their portfolios will result in incremental taxation revenues. Relying on the redistribution effect, this may be considered as a proxy of the overall economic impact on society. Although the fiscal analysis is not common practice in IFAD-supported projects, when quantifiable benefits are difficult to measure, (as in the purely RF projects without any direct impact on productivity) and therefore a traditional economic analysis is difficult to undertake, the analysis of the fiscal impacts can provide a minimum idea of the overall project impacts on the economy/society.

270. Finally, it is advisable that the stream of benefits should also take into account the non-tangible benefits such as the employment creation and the stability/robustness of the financial sector, the credibility of the government etc

**Case 1: Belize Rural finance program (IFAD, 2008)**

271. The project has three main components: i. Institutional and Capacity Building; ii. Rural Shares & Savings Incentives; iii. Rural Credit Fund;

272. Goals of the project: a) to increase the incomes of the poor small farmers by means of providing rural financial services and, particularly, credit facilities for agricultural production and rural non-agricultural activities; b) to provide incentives for rural poor affiliation to the Credit Union (72) movement and the mobilisation of savings hence diminishing their vulnerability (particularly of the extreme poor); c) to enlarge sources of funding of the Credit Unions for expanding operations in the rural sector. **Benefits of the project:** The Programme would have significant impacts in terms of the improved farming activities, on agricultural production as well as on the value of crops and livestock production. These results would mainly come from important increases in yields and productivity. To reflect the net benefits of the model, six farm models, representing agricultural systems in the project area, have been developed and used to arrive to an IRR and a NPV for the project

**Case 2: Tanzania 2010: Marketing, Infrastructure, Value Addition and rural finance support programme.**

273. In this project, the rural finance support component, which accounts for 39% of the overall costs of the project, involve different types of financing institutions: Informal Financial institutions, Savings and Credit Cooperative Societies (SACCOS), Microfinance Institutions (MFI), Community banks, Impact Investing Funds, Rural Innovation Funds.

274. The project assumes that the loans will be reinvested in different economic sectors: (agriculture, trade, other businesses and consumption), putting forward the specificity of the financing sector which is to bring liquidity to the real activity.

275. The investments in each one of these sectors will generate different profit rates of return, depending on the sector and on the type of financial institution which disbursed the loan.

276. Besides, the model supposes a same rate of failure of 10% for all sectors and for all financial institutions (see next **table 10**).

277. Based on the precedent calculations and assumptions, the project´s model makes an average of the profit rates obtained by each financial institution:

- 55% for informal financial institutions, SACCOS´s and MFI´s ,
- 49% for Community Banks and Impact Investing Funds
- 46% for rural innovation funds.

278. Are finally derived the yearly incremental benefits from the rural finance intervention (see next **table 11**)

279. Finally, to complete the CBA analysis and obtain the ERR and NPV of the whole project, the incremental benefits´ stream of the rural finance intervention is summed up to the incremental benefits of the other two interventions of the project (infrastructure and warehouse system). (See next **table 12**).

[72] The Credit Union (CU) movement in Belize consists of 13 active organizations with a total membership over 108,000 associates and total assets of BZ $352 million (March 2006). CUs mobilize savings for more than BZ $261 million, principally as members' shares, and manage a lending portfolio of more than BZ $270 million (2006). For its financial size, Credit Unions in Belize represent almost 16% of the size of the banking sector.

**Table 10: Assumptions for Estimating Benefits from Rural Finance Support**
**(Tanzania 2010: "Marketing, Infrastructure, Value Addition and rural finance support programme")**
**Distribution of Loans over portfolio.**

| Type of Financial Institution | Total Incre-mental no. of Loans | Average loan size (USD) | Distribution of New Loans | | | | | Distribution of Loans over Portfolio | | | | | | Profit rate | | | | | Rate of Failure |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PY1 | PY2 | PY3 | PY4 | PY5 | Agri-culture | Trade | Other busi-ness | Con-sump-tion | Total | Produc-tive Loans | Agri-culture | Trade | Other busi-ness | Con-sump-tion | Average | |
| | | | 5% | 15% | 20% | 25% | 35% | | | | | | | | | | | | |
| | | | Cumulative No. of Loans | | | | | | | | | | | | | | | | |
| Informal FIs | 30,000 | 150 | 1,500 | 6,000 | 12,000 | 19,500 | 30,000 | 30% | 30% | 10% | 30% | 100% | 70% | 40% | 100% | 80% | 0% | 55% | 10% |
| SACCOS | 100,000 | 450 | 5,000 | 20,000 | 40,000 | 65,000 | 100,000 | 25% | 35% | 10% | 30% | 100% | 70% | 40% | 100% | 80% | 0% | 55% | 10% |
| MFIs | 10,000 | 700 | 500 | 2,000 | 4,000 | 6,500 | 10,000 | 15% | 25% | 30% | 30% | 100% | 70% | 40% | 100% | 80% | 0% | 55% | 10% |
| Community Banks | 15,000 | 900 | 750 | 3,000 | 6,000 | 9,750 | 15,000 | 15% | 20% | 35% | 30% | 100% | 70% | 35% | 80% | 80% | 0% | 49% | 10% |
| Impact Investing Fund | 100,000 | 1,000 | 5,000 | 20,000 | 40,000 | 65,000 | 100,000 | 50% | 20% | 0% | 30% | 100% | 70% | 35% | 80% | 80% | 0% | 49% | 10% |
| FFIs via RIF | 3,000 | 500 | 150 | 600 | 1,200 | 1,950 | 3,000 | 30% | 40% | 0% | 30% | 100% | 70% | 35% | 100% | 50% | 0% | 46% | 10% |
| Total | 258,000 | | | | | | | | | | | Average | 70% | | | | | Average Success Rate | 90% |

## Table 11: Estimated Benefits from Rural Finance Support
## (Tanzania 2010: Marketing, Infrastructure, Value Addition and Rural finance support programme)

| IFIs | | year | 1 | 2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|---|---|---|
| Average loan size | | (USD) | 150 | 200 | 250 | 300 | 350 | 350 |
| Incremental no. of loans | /a | | 1,500 | 6,000 | 12,000 | 19,500 | 30,000 | 30,000 |
| Total volume of loans disbursed p.a. | | (USD) | 225,000 | 1,200,000 | 3,000,000 | 5,850,000 | 10,500,000 | 10,500,000 |
| Return on investment | /b | 55% | 348,750 | 1,860,000 | 4,650,000 | 9,067,500 | 16,275,000 | 16,275,000 |
| **Net return generated** | | (USD) | **123,750** | **660,000** | **1,650,000** | **3,217,500** | **5,775,000** | **5,775,000** |

| SACCOS | | year | 1 | 2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|---|---|---|
| No. of IFIs supported | | | 200 | 200 | 200 | 200 | 200 | 200 |
| Average loan size | | (USD) | 450 | 475 | 500 | 525 | 550 | 550 |
| Incremental no. of loans | /a | | 5,000 | 20,000 | 40,000 | 65,000 | 100,000 | 100,000 |
| Total volume of loans disbursed p.a. | | (USD) | 2,250,000 | 9,500,000 | 20,000,000 | 34,125,000 | 55,000,000 | 55,000,000 |
| Return on investment | /b | 55% | 3,487,500 | 14,725,000 | 31,000,000 | 52,893,750 | 85,250,000 | 85,250,000 |
| **Net return generated** | | (USD) | **1,237,500** | **5,225,000** | **11,000,000** | **18,768,750** | **30,250,000** | **30,250,000** |

| MFI | | year | 1 | 2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|---|---|---|
| Average loan size | | (USD) | 700 | 750 | 800 | 850 | 900 | 900 |
| Incremental no. of loans | /a | | 500 | 2,000 | 4,000 | 6,500 | 10,000 | 10,000 |
| Total volume of loans disbursed p.a. | | (USD) | 350,000 | 1,500,000 | 3,200,000 | 5,525,000 | 9,000,000 | 9,000,000 |
| Return on investment | /b | 55% | 542,500 | 2,325,000 | 4,960,000 | 8,563,750 | 13,950,000 | 13,950,000 |
| **Net return generated** | | (USD) | **192,500** | **825,000** | **1,760,000** | **3,038,750** | **4,950,000** | **4,950,000** |

| Community banks | | year | 1 | 2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|---|---|---|
| Incremental no. of loans | /a | | 1,000 | 2,000 | 3,000 | 4,000 | 5,000 | 5,000 |
| Average loan size | | (USD) | 900 | 950 | 1,000 | 1,050 | 1,100 | 1,100 |
| Total volume of loans disbursed p.a. | | (USD) | 900,000 | 1,900,000 | 3,000,000 | 4,200,000 | 5,500,000 | 5,500,000 |
| Return on investment | /b | 49% | 1,152,000 | 2,432,000 | 3,840,000 | 5,376,000 | 7,040,000 | 7,040,000 |
| **Net return generated** | | (USD) | **252,000** | **532,000** | **840,000** | **1,176,000** | **1,540,000** | **1,540,000** |

| Impact Investing Fund | | year | 1 | 2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|---|---|---|
| Average loan size | | (USD) | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Incremental no. of loans | /a | | 5,000 | 20,000 | 40,000 | 65,000 | 100,000 | 100,000 |
| Total volume of loans disbursed p.a. | | (USD) | 5,000,000 | 20,000,000 | 40,000,000 | 65,000,000 | 100,000,000 | 100,000,000 |
| Return on investment | /b | 49% | 6,400,000 | 25,600,000 | 51,200,000 | 83,200,000 | 128,000,000 | 128,000,000 |
| **Net return generated** | | (USD) | **1,400,000** | **5,600,000** | **11,200,000** | **18,200,000** | **28,000,000** | **28,000,000** |

| FFIs via RIF | | year | 1 | 2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|---|---|---|
| Average loan size | | (USD) | 500 | 500 | 500 | 500 | 500 | 500 |
| Incremental no. of loans | /a | | 150 | 600 | 1,200 | 1,950 | 3,000 | 3,000 |
| Total volume of loans disbursed p.a. | | (USD) | 75,000 | 300,000 | 600,000 | 975,000 | 1,500,000 | 1,500,000 |
| Return on investment | /b | 46% | 96,000 | 384,000 | 768,000 | 1,248,000 | 1,920,000 | 1,920,000 |
| **Net return generated** | | (USD) | **21,000** | **84,000** | **168,000** | **273,000** | **420,000** | **420,000** |

| | | year | 1 | 2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|---|---|---|
| **Overall benefit stream** | /c | | **2,032,853** | **8,143,380** | **16,769,340** | **28,144,620** | **44,689,050** | **44,689,050** |

\a Includes loans for non-productive purposes and loans with different levels of profit rates (see assumptions in Annex 6, Table 2).
\b Average (see (see assumptions in Annex 6, Table 2).
In case of IFIs and SACCOS, members need to make fixed deposits/shares taxing their returns.
\c Includes 10% loan failures.

## Table 12: Cost-Benefit Analysis - Economic Rate of Return of the programme (USD)

| | | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 | Y9 | Y10-19 | Y20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Incremental Benefits from Infrastructure Intervention** | | - | 517,183 | 1,811,709 | 3,588,939 | 5,171,833 | 5,171,833 | 5,171,833 | 5,171,833 | 5,171,833 | 5,171,833 | 5,171,833 |
| **Incremental Benefits from Warehouse System Intervention** | | - | 68,259 | 457,338 | 1,160,410 | 1,904,437 | 1,904,437 | 1,904,437 | 1,904,437 | 1,904,437 | 1,904,437 | 1,904,437 |
| **Incremental Benefits from Rural Finance Intervention** | | - | 2,032,853 | 8,143,380 | 16,769,340 | 28,144,620 | 44,689,050 | 44,689,050 | 44,689,050 | 44,689,050 | 44,689,050 | 44,689,050 |
| **TOTAL INCREMENTAL BENEFITS** | | - | 2,618,295 | 10,412,427 | 21,518,688 | 35,220,890 | 51,765,320 | 51,765,320 | 51,765,320 | 51,765,320 | 51,765,320 | 51,765,320 |
| **Programme Costs** | | | | | | | | | | | | |
| Investment Costs | | 36,742,453 | 35,121,565 | 34,082,478 | 24,908,493 | 9,579,190 | | | | | | |
| Recurrent Costs | | 1,902,186 | 2,303,036 | 2,567,916 | 2,730,386 | 2,474,736 | | | | | | |
| **Costs Year 6 - 20** | | | | | | | | | | | | |
| Percentage of Programme Recurrent Costs in PY5 | 30% | | | | | | 742,421 | 742,421 | 742,421 | 742,421 | 742,421 | 742,421 |
| Percentage of of Total Civil Works Costs (PY1-PY5) (O&M Civil Works) | 10% | | | | | | 4,297,130 | 4,297,130 | 4,297,130 | 4,297,130 | 4,297,130 | 4,297,130 |
| **TOTAL COSTS** | | 38,644,639 | 37,424,601 | 36,650,394 | 27,638,879 | 12,053,926 | 5,039,551 | 5,039,551 | 5,039,551 | 5,039,551 | 5,039,551 | 5,039,551 |
| **NET INCREMENTAL PROGRAMME BENEFITS (CASH FLOW)** | | - 38,644,639 | - 34,806,306 | - 26,237,967 | - 6,120,190 | 23,166,964 | 46,725,769 | 46,725,769 | 46,725,769 | 46,725,769 | 46,725,769 | 46,725,769 |
| **ECONOMIC RATE OF RETURN (ERR)** | | **24.4%** | | | | | | | | | | |
| **NET PRESENT VALUE (NPV)** | | **147,270,072** | | | | | | | | | | |

### *Environmental projects*

### *Natural resources management benefits*

280. Sustainable natural resources management is the use of natural resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions (UN Earth Summit, 1992). Sustainable natural resources management practices include reduction of soil erosion, compaction and salinity, conservation or drainage of soil water, maintenance or improvement of soil fertility, natural disasters prevention, and all actions that imply mitigation or adaptation to climate change.

281. Economic/financial analysis of soil erosion and conservation is complex due to problems concerning the availability and accuracy of data, the evaluation of the effects of soil erosion and the erosion rate. Land degradation resulting from soil erosion is not just about soil loss but also about the loss of nutrients. Overall, it is about loss of productivity. Although, there are no reliable estimates of either soil loss or nutrient loss, some project have estimated soli degradation assuming an XX% as the annual percentage loss in productive capacity and constant production costs, by looking at past annual productivity trends. **(see example below Kirehe Community Based Watershed management project, Rwanda 2007)**

282. Quantifiable benefits from Sustainable Natural Resources Management can be derived from:

- **Reduced land erosion**: in order to estimate the amount of soil "saved" from erosion each year, 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
- **Avoiding** rehabilitation costs of public infrastructure destroyed by **natural disasters**
- **Energy saving** thanks to replacement of old practices by eco-friendly artefacts (eco-stoves, solar panels, etc…). For an example of economic benefits of eco-stoves and solar panels see in annex the Murat rehabilitation watershed project 2011)

283. More in particular, reforestation73, afforestation74 and agroforestry75 practices are likely to produces **economic** benefits (from growing seedlings, planting and cultivating all source of trees

[73] Reforestation is the reestablishment or expansion of a forest which was previously destroyed or degraded. Sometimes the reforestation occurs through natural regeneration, when seeds from existing stands of trees are deposited on deforested lands, distributed by either wind, insects, birds, or other seed dispersers. Other times lands are reforested artificially, by planting trees on degraded or deforested lands, with species that are native to that area (definition from the Ecologic Development Fund).

[74] Afforestation is the establishment of a forest or stand of trees in an area where there was no forest (definition from the Dictionary of forestry)

that will provide firewood and wood for construction and furniture), as well as **environmental** benefits (erosion control, maintenance of the water cycle, habitat for biodiversity, water purification, mitigation of extreme weather events, enhanced pollination, enrichment of the soil, and increase of carbon sequestration).

284. The benefit of establishing physical soil conservation structures e.g. grass barriers, terraces, etc.. is the avoided costs of reconstruction after extreme weather events.

285. Conserving/restoring biodiversity and habitats (e.g. preserving mangroves maintains the ecosystem equilibrium. Mangroves produce a high quantity of organic material, they are the habitat of fishes, seafood, birds, mammals and marine organisms), preserve the coast from ties and erosion and therefore avoid economic losses and generate life and biodiversity.

**<u>Case study:</u> The Kirehe Community Based Watershed management project (Rwanda 2007- Table 13)**

286. The objective of the project is to introduce progressive terracing as anti-erosive soil conservation measures to protect the area through planting of agro-forest trees and cuttings of penissetum, within the planned 6 years lifespan of the project. Twenty-five per cent of the project funds have been allocated for soil conservation therefore there is a clear need to demonstrate that soil conservation measures are viable investments. This analysis looks simply at the 'without project' situation called, in this case, the 'do-nothing scenario'. This scenario assumes that with a continuation of current agronomic practices the current 1,5% annual percentage loss in productive capacity will results in 1,5% loss in production revenue each year and income is consequently foregone. Investment in soil conservation would prevent this loss of income. The benefit of the investment in soil conservation is calculated deducting from the incremental income, the costs of soil conservation investment and the related Operation &Maintenance Costs which are assumed to be 20% of the original earthwork costs. The model records an IRR of 58,4% (**see table 13**).

287. **IRR is derived by comparing net income from "with" and "without" terracing and planting of agro-forest trees.**

[75] Agroforestry combines agriculture and forestry to create integrated and sustainable land-use systems. Agroforestry takes advantage of the interactive benefits from combining trees and shrubs with crops and/or livestock (definition from the USDA National Agroforestry Center)

**APPENDIX III**
**REBUBLIC OF RWANDA**
**KIREHE COMMUNITY-BASED WATERSHED MANAGEMENT PROJECT (KWAMP)**
**Table 3.1: Model Dryland with 0,1 ha of paddy rice with livestock**

| | | | WOP | With Project | | | |
|---|---|---|---|---|---|---|---|
| **PRODUCTION AND INPUTS (in Units)** | **Unit** | **Prices** | **1 to 30** | **1** | **2** | **3** | **4 to 30** |
| **Main Production** | | | | | | | |
| Beans | kg | 400 | 205 | 205 | 128 | 144 | 160 |
| Banana | unit | 50 | 1360 | 1360 | 890 | 1000 | 1170 |
| Cassava | kg | 125 | 670 | 770 | 350 | 392 | 460 |
| Maize | kg | 125 | 96 | 96 | 36 | 44 | 50 |
| Rice | kg | 165 | - | 260 | 300 | 350 | 400 |
| Forage | FU | 80 | - | 250 | 500 | 500 | 500 |
| Milk | litre | 120 | - | 450 | 450 | 450 | 450 |
| Manure | tonne | 5000 | - | - | 3 | 3 | 3 |
| Meat | head | 200000 | - | - | 0.16 | 0.16 | 0.16 |
| Yearling Bull | head | 200000 | - | - | 0.47 | 0.47 | 0.47 |
| ***Investment Costs*** | | | | | | | |
| Irrigation and Livestock Scheme (farmer contrib | ha | 1546875 | | 0.16 | | | |
| **Purchased Inputs** | | | | | | | |
| Bean Seeds | Kg | 400 | 12 | 12 | 6 | 6 | 6 |
| Cassava Cuttings | Kg | 8 | 1 000 | 1 000 | 480 | 480 | 480 |
| maize seeds | Kg | 125 | 4.8 | 4.8 | 2 | 2 | 2 |
| Rice seeds | Kg | 165 | - | 3 | 3 | 3 | 3 |
| Forage Cuttings | Kg | 5 | - | 4 000 | 8 000 | 8 000 | 8 000 |
| grains | Kg | 10000 | - | 0.05 | 0.1 | 0.1 | 0.1 |
| NPK | Kg | 350 | - | - | 25 | 25 | 25 |
| Lime | kg | 35 | - | - | 125 | 125 | 125 |
| Pesticides | Kg | 3000 | - | - | 0.2 | 0.2 | 0.2 |
| Concentrated | kg | 200 | - | - | 120 | 120 | 120 |
| Veterinary services | Frw | | - | - | 30 000 | 30 000 | 30 000 |
| labour | day | 250 | 173.4 | 163.1 | 283.5 | 283.5 | 283.5 |

| | | WOP | With Project | | | |
|---|---|---|---|---|---|---|
| **FINANCIAL BUDGET (AGGREGATED)** | (In Rfw) | **1 to 30** | **1** | **2** | **3** | **4 to 30** |
| **Revenue** | | | | | | |
| Beans | | 81 920 | 81 920 | 51 200 | 57 600 | 64 000 |
| Banana | | 68 000 | 68 000 | 44 500 | 50 000 | 58 500 |
| Cassava | | 83 750 | 96 250 | 43 750 | 49 000 | 57 500 |
| Maize | | 12 000 | 12 000 | 4 500 | 5 500 | 6 250 |
| Rice | | - | 42 900 | 49 500 | 57 750 | 66 000 |
| Forage | | - | 20 000 | 40 000 | 40 000 | 40 000 |
| Milk | | - | 54 000 | 54 000 | 54 000 | 54 000 |
| Manure | | - | - | 15 000 | 15 000 | 15 000 |
| Meat | | - | - | 32 000 | 32 000 | 32 000 |
| Yearling Bull | | - | - | 94 000 | 94 000 | 94 000 |
| **Total Revenue** | | **245 670** | **375 070** | **428 450** | **454 850** | **487 250** |
| **Investment Costs** | | | | | | |
| Irrigation and Livestock Scheme (farmer contribution) | | **-** | **247 500** | **-** | **-** | **-** |
| **Production Cost** | | | | | | |
| Sub-Total Inputs/seeds Cost | | ***13 400*** | ***34 395*** | ***47 935*** | ***47 935*** | ***47 935*** |
| Sub-total Fertilizers | | **-** | **-** | ***13 725*** | ***13 725*** | ***13 725*** |
| Concentrated | | - | - | 24 000 | 24 000 | 24 000 |
| Veterinary services | | - | - | 30 000 | 30 000 | 30 000 |
| Irrigation Scheme O&M costs | | 62 040 | 62 040 | 62 040 | 62 040 | 62 040 |
| Livestock Watering points O&M at 2% per annum of capital cost | | 3 960 | 3 960 | 3 960 | 3 960 | 3 960 |
| Labour | | 43 338 | 40 775 | 70 875 | 70 875 | 70 875 |
| **Sub-Total Production Cost** | | **122 738** | **388 670** | **252 535** | **252 535** | **252 535** |
| **Net Income before Financing** | | 122 933 | -13 600 | 175 915 | 202 315 | 234 715 |
| **Incremental Net Income (before financing)** | | | -136 533 | 52 983 | 79 383 | 111 783 |
| **Returns per Family-Day of Labour** | | 709 | N/A | 621 | 714 | 828 |
| **NPV @8% (RWF)** | 444 017 | | | | | |
| **IRR** | 58.4% | | | | | |
| **Benefit/Cost Ratio** | | 2.0 | 1.0 | 1.7 | 1.8 | 2 |

**Cash Flow Analysis**

| Items | Without Project | With Project | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 to 30 |
| ***Inflow*** | | | | | |
| Production Revenues | 245670 | 375070 | 428450 | 454850 | 487250 |
| Beneficiary's Contribution (kind or cash from own savings) | - | 247 500 | | | |
| ***Total Inflow*** | ***245 670*** | ***622 570*** | ***428 450*** | ***454 850*** | ***487 250*** |
| ***Outflow*** | | | | | |
| Production Costs | 122738 | 388670 | 252535 | 252535 | 252535 |
| *Repayment* | | | | | |
| In kind | 0 | 247 500 | 0 | 0 | 0 |
| ***Total Outflow*** | ***122738*** | ***636170*** | ***252535*** | ***252535*** | ***252535*** |
| **Net Income after Financing** | ***122933*** | ***-13600*** | ***175915*** | ***202315*** | ***234715*** |
| Taxes 5 % | 6 147 | 0 | 8 796 | 10 116 | 11 736 |
| **Net Income after Tax** | **116 786** | **-13 600** | **167 119** | **192 199** | **222 979** |
| Incremental Production Revenues | | 129 400 | 182 780 | 209 180 | 241 580 |
| NPV @8% (thousand RWF) 1 441 019 | | | | | |
| Incremental Total Inflow | | 376 900 | 182 780 | 209 180 | 241 580 |
| NPV @8% (thousand RWF) 1 670 186 | | | | | |
| Incremental Production Costs | | 265 933 | 129 798 | 129 798 | 129 798 |
| NPV @8% (thousand RWF) 997 003 | | | | | |
| Incremental Investments | | 247 500 | | | |
| NPV @8% (thousand RWF) 229 167 | | | | | |
| Incremental Outflow | | 513 433 | 129 798 | 129 798 | 129 798 |
| NPV @8% (thousand RWF) 1 226 169 | | | | | |
| ***Incremental Net Income*** | | ***-130 386*** | ***50 333*** | ***75 413*** | ***106 193*** |
| NPV @8% (thousand RWF) 421 186 | | | | | |
| FIRR 58.8% | | | | | |

| **Switching Values** | **Appraisal Value** | **Switching Value** | **% Change** |
|---|---|---|---|
| Incremental Revenues | 1 441 019 | 1 019 833 | -29% |
| **Incremental Inflows** | 1 670 186 | 1 249 000 | -25% |
| Incremental Production Costs | 997 003 | 1 418 189 | -42% |
| Incremental Investments | 229 167 | 650 353 | -184% |
| **Total Incremental Outflows** | 1 226 169 | 1 647 356 | -34% |

### *Mitigation and adaptation benefits in the carbon markets*

288. Agriculture is a major source of Green House Gas (GHG) emissions, contributing 14% of global emissions or about 6.8 Gt of CO2 equivalents per year (IPCC 2007). Improved agricultural practices such as changes in tillage practices, crop rotations, land conversion to grasslands and afforestation, can reduce emissions from agriculture by storing/sequestering carbon in plant biomass and soils.

289. Carbon sequestration activities have been supported through the CDM (Clean Development Mechanism) under the Kyoto protocol[76] , which allocates a monetary value to sequestered carbon through the certified emission reduction credits (CER). Agriculture and forestry development projects could play an important role in climate change mitigation - either by reducing emissions or by sequestering carbon (C), while at the same time contributing to food security and rural poverty reduction. In this context, some models are being developed to estimate the mitigation potential from changes in agricultural production systems and to support project managers on climate change mitigation decision making. EX-ACT (EX-Ante Carbon-balance Tool) is one of such models developed by FAO to provide an ex-ante evaluation of the impact of rural development projects on GHG emissions and C sequestration, thus estimating the potential contribution of agriculture (and forestry) sector to climate change mitigation. The main output of the tool consists of the carbon balance resulting from the difference between two alternative scenarios: “without project” (the “Business As Usual” or “Baseline”) and “with project”.

**<u>Case study:</u> application of the EX-Ante Carbon-balance Tool (EX-ACT) in Brazil (see annex)**

290. The Brazilian state government of Rio de Janeiro volunteered to participate in the EX-ACT tool field testing process from September 2009 to February 2010 with the Rio de Janeiro Sustainable Rural Development project (Rio Rural) financed through a World Bank loan (50% of total cost) and State Government own resources.

291. EX-ACT can be used to assess the mitigation potential of agricultural projects corresponding to different land use patterns simulated in project scenarios.

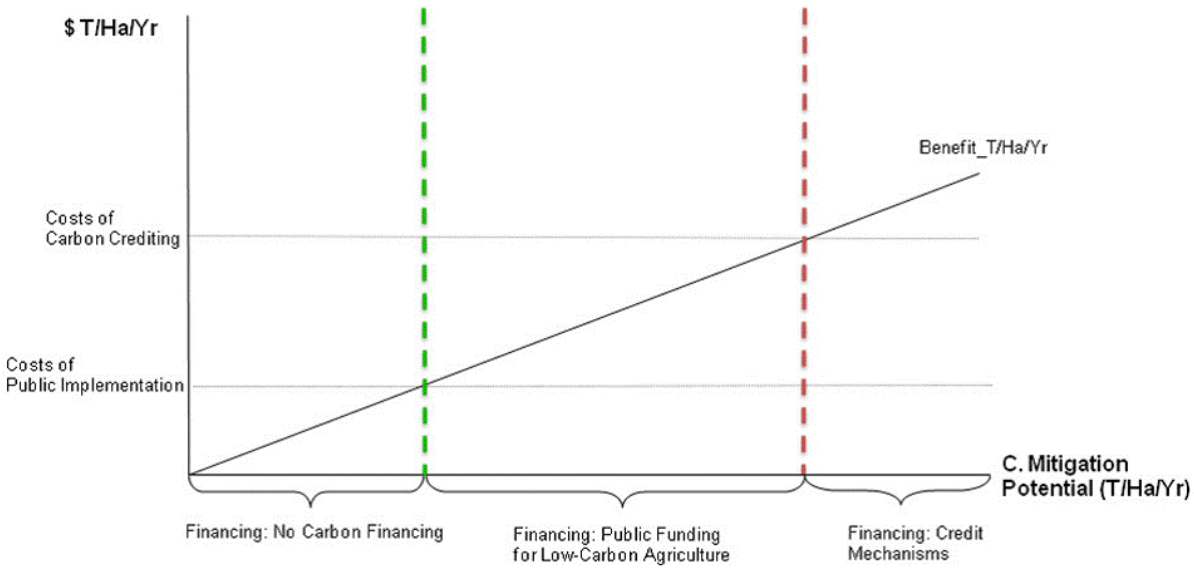
[76] The Clean Development Mechanism (CDM), defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO2, which can be counted towards meeting Kyoto targets. A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers.

292. Based on this estimate, it is possible to classify projects which are of interest for agricultural development:

- Type 0 – no mitigation potential;
- Type 1 – low mitigation potential;
- Type 2 – medium mitigation potential; and
- Type 3 – high mitigation potential.

293. In the case of the Rio Rural project, the average mitigation potential of the project is equal to 0.92 tCO2e/ha per year. It could be valued using a price of 3 US$/tCO2e, which is the average carbon price for agricultural soil carbon at retail level on the voluntary carbon market in 2008 (Hamilton et al. 2009). Therefore, the value of the average mitigation potential of the project amounts to 2.76 US$/ha (per year). Since this value is below the level of transaction cost for public implementation (4 US$/ha), the project can be classified as type 1 (Agriculture Development) without any feasible option of being financed on the C sector (see figure 1)

**Figure 1:** Financing options for agriculture development and mitigation projects




Source: adapted from FAO 2009.

294. However, it is interesting to note that a relatively limited change in project design could slightly increase the mitigation potential of the project and transform it in a type 2 one. For example, the mitigation potential of the project in the "optimistic scenario" outlined above is equal to 1.1 tCO2e/ha per year. Clearly, if the project is designed with explicit multiple objectives with specific mitigation activities, it will be easily increase its mitigation potential.

295. If the corresponding mitigation potential value exceeds the level of transaction costs for public implementation, the project could then be potentially considered for public financing for low-Carbon agriculture. Being this the case, since yearly mitigation potential of the SC Rural project would be equal to 0.6 MtCO2e, mitigation benefits would be worth 1.8 million US$/year at the price of 3 US$/tCO2e. Given that total average project cost is 31.5 US$ million/year, public carbon finance would potentially cover about 6% of these costs.

### *Losses reduction from flooding, landslides and droughts*

296. Projects which include activities preventing natural disasters generate benefits from reduced erosion and benefits from reduction/ avoidance of economic future losses due to flooding and other natural disasters. Activities related to reduction of natural disaster are listed in the table below:

**Investments in degraded land, soil and vegetation:**

| Activity | Benefit |
|---|---|
| Erosion control | • Reduced risk of flooding/landslides destroying property, infrastructure or lives<br>• Improved vegetative cover<br>• Increased income through public works |
| Rehabilitation of grazing land | • Improved livestock production<br>• Potential short term negative impact of loss of grazing land |
| Afforestation activities | • Increased income through short term employment<br>• Improved natural resource base<br>• Long term improved wood production<br>• Decreased risk flooding/landslides |

Source: IFAD project report Murat river Watershed rehabilitation project (2011)

297. Generally the quantification of these benefits are not easy to realize, challenges such as how to valuate human lives that could be lost in a natural disaster are part of the problem.

**<u>Case study:</u> In the Murat River Watershed Rehabilitation Project, among a range of interventions the project aims at:**

- Implementing erosion control works that reduce the likelihood of destructive flooding and landslides in the future, and so curve the very high costs of repairs to damaged infrastructure. The **benefit** of this kind of intervention **is the avoided cost of having to rehabilitate and reconstruct the infrastructure destroyed by the natural disaster.** See annex Murat river (Turkey) watershed rehabilitation project (2011).

- Using **solar water heaters** and **fuel efficient stoves** in order to diversify and make a more efficient domestic use of energy, reducing the unsustainable annual demand of fuel wood to heat water and the home (See annex Murat river (Turkey) watershed rehabilitation project (2011) for an example of the evaluation of these benefits).

298. The Murat River project implements erosion control works that reduce the likelihood of destructive flooding and landslides in the future, and so curve the very high costs of repairs to damaged infrastructure. The **benefit** of this kind of intervention is **the avoided cost of having to rehabilitate and reconstruct the infrastructure destroyed by the natural disaster:**

| ANNUAL BENEFIT FROM INFRASTRUCTURE REPAIR COSTS CAUSED BY NATURAL DISASTER IN THE PROJECT PROVINCES | | | | | |
|---|---|---|---|---|---|
| Province | Year | Sanitation | Drinking water | Roads | TOTAL EXPENDITURES |
| Bingol | 2006 | 23.800.000 | 10.600.000 | 5.500.000 | 39.900.000 |
| **Amortized over 20 years (39.900.00/20 years)** | | | | | 1.995.000 |

Benefits from eco- stoves and solar panels:

299. Another intervention in the Murat River Project concerns the efficient use of energy:

300. Most houses in the project villages are heated with simple and inefficient stoves burning wood, coal and dung, which also heat water for washing and bathing purposes. In upland villages, due to insufficient or lack of affordable alternative energy sources, the demand for fuel wood is very high; it is estimated that a community of fifty households uses at least 100 mt a year, which corresponds to about 100,000 ha of oak coppice.

301. In this unsustainable situation, project investments in energy resources are designed to reduce the overall demand for fuel and excessive reliance on fuel wood and to promote the use of affordable renewable energy sources in the upland villages. Therefore, about one-quarter of benefiting households would be provided with energy-saving technologies, which comprise:

**(a)** The installation of solar-powered water heating systems (particularly the "closed system" developed in Turkey because of its suitability for high altitudes and cold temperatures);
**(b)** Fuel-efficient stoves; and
**(c)** Other small-scale energy-saving technology as deemed appropriate and feasible by the project.

302. Hereafter is presented the monetary evaluation of wood savings from the use of stoves and solar panels. In the end is presented the summary of benefits stream and the overall internal rate of return of the project.

| Estimated Volumes of Wood Saving to be obtained by Efficient Stoves' Use: | | | | |
|---|---|---|---|---|
| **Year** | **Number of stoves distributed** | **Number of stoves In use** | **Amounts of wood saving (ton/year)** | **Value of wood saving (TYL/Year)** |
| 1 | | | | |
| 2 | 225 | | | |
| 3 | 450 | 225 | 146 | 21.938 |
| 4 | 600 | 675 | 439 | 65.813 |
| 5 | 600 | 1275 | 829 | 124.313 |
| 6 | | 1875 | 1.219 | 182.813 |
| 7 | | 1875 | 1.219 | 182.813 |
| 8 | | 1875 | 1.219 | 182.813 |
| 9 | | 1875 | 1.219 | 182.813 |
| 10 | | 1875 | 1.219 | 182.813 |
| 11 | | 1875 | 1.219 | 182.813 |
| 12 | | 1875 | 1.219 | 182.813 |
| 13 | | 1875 | 1.219 | 182.813 |
| 14 | | 1875 | 1.219 | 182.813 |
| 15 | | 1875 | 1.219 | 182.813 |
| 16 | | 1875 | 1.219 | 182.813 |
| 17 | | 1875 | 1.219 | 182.813 |
| 18 | | 1875 | 1.219 | 182.813 |
| 19 | | 1875 | 1.219 | 182.813 |
| 20 | | 1875 | 1.219 | 182.813 |
| 21 | | 1875 | 1.219 | 182.813 |
| 22 | | 1875 | 1.219 | 182.813 |
| 23 | | 1875 | 1.219 | 182.813 |
| 24 | | 1875 | 1.219 | 182.813 |
| 25 | | 1875 | 1.219 | 182.813 |
| **TOTAL** | **1.875** | **39.675** | **25.789** | **3.868.313** |

**Estimated volume of wood and number of trees to be saved by one efficient stove:**

| Village type | Annual wood consumption per HH | | Estimated wood saving (ton/HH/year) | | Estimated number of small trees saved (Number of trees/HH/year) | | |
|---|---|---|---|---|---|---|---|
| | Stere | ton | Stove only (25%) | Stove plus insulation (40%) | Average (25%) | Optimistic (50%) | |
| **Within the forest** | **30** | **2,0** | **0,5** | **0,8** | **2** | **4** | |
| **Near forest** | **15** | **2,0** | **0,5** | **0,8** | **2** | **4** | |
| **Average** | | | **0,5** | **0,8** | **Average price (TYL/ton) (standing)** | | **150** |
| | | | **65%** | | | | |
| Price of stove | | 1.600 | | 1,3 | | | |
| Expenditures for stoves | | 3.000.000 | | | | | |
| Net Value of saved wood | | 868.313 | | | | | |

## Estimated volume of wood and number of tree to be saved by solar water heater

| No. | Village type | Annual wood consumption per HH | | Estimated wood saving (ton/HH/year) | | Estimated small trees saved (number of trees/HH/year) | |
|---|---|---|---|---|---|---|---|
| | | Stere | ton | Average (50%) | Optimistic (75%) | Average (50%) | Optimistic (75%) |
| 1 | Within the forest | 7 | 1,0 | 0,5 | 0,8 | 2,5 | 3,8 |
| 2. | Near forest | 4 | 1,0 | 0,5 | 0,8 | 2,5 | 3,8 |
| | Average | | | 0,5 | 0,8 | 2,5 | 3,8 |
| | | | | 0,63 ((0,5 +0,8)/2) | | 3,1 ((2,5+3,8)/2) | |

| | TYL (Turkish lira) |
|---|---|
| Price of solar | 1.600 |
| Value of saved wood | 2.479.688 |
| Value of 1 ton wood | 150 |

**Estimated Volumes of Wood Saving to be obtained by Solar Water Heater's Use**

| Year | Heaters purchased | Number of heaters used | Wood saved (ton/year) | Value of wood saved (TYL/Year) |
|---|---|---|---|---|
| 1 | | | | |
| 2 | 150 | | | |
| 3 | 300 | 150 | 93,8 | 14.063 |
| 4 | 400 | 450 | 281,3 | 42.188 |
| 5 | 400 | 850 | 531,3 | 79.688 |
| 6 | | 1250 | 781,3 | 117.188 |
| 7 | | 1250 | 781,3 | 117.188 |
| 8 | | 1250 | 781,3 | 117.188 |
| 9 | | 1250 | 781,3 | 117.188 |
| 10 | | 1250 | 781,3 | 117.188 |
| 11 | | 1250 | 781,3 | 117.188 |
| 12 | | 1250 | 781,3 | 117.188 |
| 13 | | 1250 | 781,3 | 117.188 |
| 14 | | 1250 | 781,3 | 117.188 |
| 15 | | 1250 | 781,3 | 117.188 |
| 16 | | 1250 | 781,3 | 117.188 |
| 17 | | 1250 | 781,3 | 117.188 |
| 18 | | 1250 | 781,3 | 117.188 |
| 19 | | 1250 | 781,3 | 117.188 |
| 20 | | 1250 | 781,3 | 117.188 |
| 21 | | 1250 | 781,3 | 117.188 |
| 22 | | 1250 | 781,3 | 117.188 |
| 23 | | 1250 | 781,3 | 117.188 |
| 24 | | 1250 | 781,3 | 117.188 |
| 25 | | 1250 | 781,3 | 117.188 |
| TOTAL | | 325.000 | 16.531 | 2.479.688 |

**Murat River Watershed rehabilitation project 2011:**
**Costs and benefits of the different interventions, among which stoves, solar panels and works to reduce floodings and landslides. IRR of overall project.**

**BENEFIT STREAM (in Turkish Lira)**

| | YR 1 | YR 2 | YR 3 | YR 4 | YR 5 | YR 6 | YR 7 | YR 8 | YR 9 | YR 10 | YR 11 | YR 12 | YR 13 | YR 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Improved stoves | - | | | | 65.813 | 124.313 | 182.813 | 182.813 | 182.813 | 182.813 | 182.813 | 182.813 | 182.813 | 182.813 |
| Solar panels | - | | | 14.063 | 42.188 | 79.688 | 117.188 | 117.188 | 117.188 | 117.188 | 117.188 | 117.188 | 117.188 | 117.188 |
| Greenhouses | - | - | (141.412,8) | (419.055) | (715.562) | (529.838) | 533.193 | 655.424 | 682.204 | 572.387 | 433.286 | 433.286 | 733.452 | 733.452 |
| Walnut | - | - | | (9.440) | (284.560) | (419.760) | (472.419) | (95.654) | 17.283 | 239.190 | 608.170 | 1.166.058 | 1.662.954 | 1.912.042 |
| Improved barns/stables | - | - | (364.500) | (450.900) | (137.700) | 603.900 | 2.317.500 | 2.317.500 | 2.317.500 | 2.317.500 | 2.317.500 | 2.317.500 | 2.317.500 | 2.317.500 |
| Soil loss | | | | | | | | 99.725 | 98.936 | 98.148 | 97.360 | 96.572 | 95.783 | 94.995 |
| Infrastructure | - | - | | | | | 1.995.000 | 1.995.000 | 1.995.000 | 1.995.000 | 1.995.000 | 1.995.000 | 1.995.000 | 1.995.000 |
| Total benefits | - | - | (505.913) | (865.333) | (1.029.822) | (141.698) | 4.673.273 | 5.271.994 | 5.410.924 | 5.522.226 | 5.751.315 | 6.308.415 | 7.104.689 | 7.352.989 |
| **COST STREAM** | | | | | | | | | | | | | | |
| Investment costs | 1.762.967 | 5.227.888 | 10.520.711 | 13.634.061 | 13.419.856 | 6.821.324 | 1.088.581 | | | | | | | |
| Recurrent costs | 217.086 | 259.880 | 326.743 | 424.237 | 492.332 | 547.067 | 493.860 | 395.088 | 296.316 | 197.544 | 98.772 | 49.386 | 49.386 | 49.386 |
| Total cost | 1.980.053 | 5.487.768 | 10.847.454 | 14.058.298 | 13.912.188 | 7.368.390 | 1.582.441 | 395.088 | 296.316 | 197.544 | 98.772 | 49.386 | 49.386 | 49.386 |
| **INCREMENTAL BENEFIT** | (1.980.053) | (5.487.768) | (11.353.367) | (14.923.631) | (14.942.010) | (7.510.088) | 3.090.833 | 4.876.906 | 5.114.608 | 5.324.682 | 5.652.543 | 6.259.029 | 7.055.303 | 7.303.603 |
| **IRR (Calculated with data over 25 years)** | 6,9% | | | | | | | | | | | | | |

***Land Tenure benefits:***

303. Empirical evidence from IFAD's interventions shows how security of land tenure encourages investment on land fertility and thus increases agricultural productivity. In their study based on Ghana, Goldstein and Udry (2008) find that owners with more secure land tenure tend to invest more on their land productivity and have substantially higher outputs, e.g. farmers with secure land tenure tend to allow sufficient time for fallowing. The study also shows that those without secure land tenure, particularly women, tend to fallow their allocated plots less, yielding much less return. (from Review of Impact Evaluations in the Main Development Sectors, Asian Development Bank)

304. The benefits from projects that improve land tenure security may translate into an **increased land value** explained by:

- Investments for land fertility and long term investments such as: housing improvements, other buildings, irrigation systems, permanent crops, pastures, forestry, etc. are encouraged by secured land tenure.
- Improve access to credit as land can be used as a collateral guarantee for credit.
- Increased efficiency in the dynamism of land markets: greater agility in the purchase, sale, division, merge and transfer of land.
- Environmental benefits as a result of better NRM.

305. All these benefits however are generally included in the description of Incremental Net Benefits in each farm or production model. Therefore, attention should be paid not to duplicate these benefits in the EFA.

306. The consideration of incremental land value could be included in the analysis if not particular increases in productivity are otherwise reflected.

**<u>Case study</u> of Land Administration Project in Nicaragua (analysis from FAO Investment Center for WB Land Administration Project, 2002):**

307. The economic analysis in this project is based on estimating the expected impact on land values resulting from securing tenancy. Data series from a major survey were used in the analysis. These data series showed expected value differentials statistically significant in favour of registered rural land, with respect to non-registered rural land. The underlying reasons for incremental benefits of registered land compared to non-registered are stated above and in the analysis are summarized in increased value of land.

308. Consistent with theory and common perceptions of rural people (surveyed for this analysis), the sale price of rural land reflects future net benefit flows of production activities over a medium to long term. Therefore, strong and active rural land markets are perceived as indicators of increased future production and economic activity. According to the econometric study, an average of 22% increase in land value would be expected. (See annex, table 14)

309. Summary of results on value differentials between registered and non-registered land, for different land qualities and land use categories.

**Table 14: Apparent Values of Rural Land in USD/Mz**

| Topography | *Use* | Situation without registry | | Situation with registry | |
|---|---|---|---|---|---|
| | | $\mu$ | Range ($\sigma$ - $\mu + \sigma$) | $\mu$ | Range ($\sigma$ - $\mu + \sigma$) |
| Flat-irregular | Annual crops | 184 | 136 - 232 | 229 | 181 - 277 |
| Flat-irregular | Perennial crops | 325 | 260 - 390 | 370 | 305 - 435 |
| Flat-irregular | Pastures | 99 | 49 - 149 | 144 | 94 - 194 |
| Flat-irregular | Forest | 193 | 99 - 287 | 129 | 35 - 223 |
| Flat-irregular | Idle | 174 | 84 - 264 | 219 | 129 - 309 |
| Flat-irregular | Housing-*Solar* | 2,160 | 2,086 - 2,234 | 2,205 | 2,131 - 2,279 |
| | | | | | |
| Abrupt | Annual crops | 88 | 40 - 136 | 133 | 85 - 181 |
| Abrupt | Perennial *crops* | 216 | 151 - 281 | 261 | 196 - 326 |
| Abrupt | Pastures | - | - 50 | 35 | - 85 |
| Abrupt | Forest | 84 | - 178 | 129 | 35 - 223 |
| Abrupt | Idle | 65 | - 155 | 110 | 20 - 200 |
| Abrupt | Housing-*Solar* | 1,976 | 1,902 - 2,050 | 2,021 | 1,947 - 2,095 |

310. $\mu$ represents the mean or average value and $\sigma$ represents the standard deviation. The range ($\sigma$ - $\mu + \sigma$) in a normal distribution includes 68% of the observed values.

## *Alternative methodology to the CBA: the cost effectiveness method*

311. Many projects generate benefits that are very difficult to measure or not measurable in monetary terms (called “intangible” benefits). Projects aiming at institutional strengthening, reinforcing community development, social rural infrastructure construction such as roads, schools and clinics or rural electrification are some examples. In these cases alternative methodologies to CBA should be applied. The most commonly used is the cost- effectiveness method.

312. Cost effectiveness is used to select the least cost alternative, given a set of pre-determined objectives (Merit needs). Once the purpose of the project has been decided, cost effectiveness would be used to compare scale, location, technology etc., to choose between project options.

313. The methodology consist in firstly list and measure in monetary terms the costs of the options available and then compare them with the costs occurring in the base scenario (without the project). Total costs are then discounted at year [1] and the results compared in order to identify the cheapest intervention. In other words, the method of “least cost combination “or “cost effectiveness” consists in determining on a present worth basis the different alternatives

combination of costs that will realize the same benefit77

314. However, the results of this method that will help us decide and justify project's investment decisions, cannot be integrated to the streams of incremental net benefits resulted from a classic CBA, underestimating the overall benefits from this investment.

315. For an example of cost effectiveness method see Annex, table 15: Yunnan Agricultural and rural improvement project (China 2011).

**<u>Case study:</u> Community Driven Development (CDD) projects benefits: The Kalahi-CIDSS Project, Philippines (Social Development Papers, World Bank, 2007 – table 16)**

316. Community driven development (CDD) projects grant control of the development process, resources and decision making to community groups. In CDD projects, communities or locally based representation are responsible for designing and planning the subprojects, in a participatory manner78

317. CDD projects create as a first benefit, the **empowerment** of the members of the community and in a second phase, a sense of **ownership** of each and every investment generated by the community (example: roads, storage and processing facilities or education and health facilities).

318. Community/demand –driven projects generates a number of "intangible" benefits listed below:

- **Transparency:** The community knows every aspect of project decision-making. Financial management of project funds is open and shared with the entire community.
- **Institutional Capacity-Building:** Formal and informal institutions working in the villages and will be encouraged to participate in project planning, implementation, and maintenance. Besides, participatory approaches require accountable and dynamic institutions that respond to community´s consultations and demands.
- **Empowerment:** Communities take ownership of all aspects of projects, from planning and decision-making to implementation.
- **Social Inclusion:** Whole communities—not just a few families—have the opportunity to be involved in decision-making. Inclusion implies to ensure the active participation of women, the poor, and vulnerable groups**.**
- **Sustainability and ownership:** operation and maintenance will be sustainable and performed by local stakeholders, increasing as a consequence adoption rates.

319. Measuring the above benefits is very difficult. However a classic CBA is possible when the project intervention is limited to productive investments through CDD, actually the fact that communities are empowered and the levels of ownership of social infrastructure are high, will

[77] Gittinger. 1982. *Economic analysis of agricultural projects*.

[78] Example: volunteers discuss development issues affecting the community and prioritize them. The final output could be the village/ community action plan/projects type selection among a range of options.

certainly guarantee sustainability of the investment as well as increase responsible management of social resources including engagement in operating and maintenance community participation.

320. In the cases where project core interventions are focused on capacity building and institutional strengthening, it would be more suitable to apply a cost- effectiveness analysis to avoid having to quantify intangible benefits.

321. An alternative is the use of qualitative surveys to assign some value to the intangible benefits by consulting with the final beneficiaries. An example of how this could be done is the Kalahi project. Aiming at empower communities by enhancing their participation in village-level governance, community members are involved in designing, implementing, and managing of development activities to reduce poverty. The subprojects with the highest community demand are road projects, accounting for 37 % of all sub projects, followed by water projects, which accounted for 32 %.

322. Quantified benefits from the seven major infrastructure sub project categories were included in the CBA analysis. Annex, table 14, shows the survey used in the field to value the benefits for water provision.

**Cost-effectiveness Analysis of Rural Road Design: Yunnan Agricultural and rural improvement project (China 2011).**

323. Yunnan Agricultural and rural improvement project includes one component for community infrastructure with village road construction and pavement that would be carried out in 207 nature villages.

324. Cost effectiveness is used to select the least cost road 79design given a set of pre-determined objectives. The objectives of the rural roads sub-component include 1) all year access (minimum 320 days), 2) expected life of the investment (15+ years minimum) and 3) minimal maintenance costs.

325. Normally, once the purpose of the project has been decided, cost effectiveness would be used to compare scale, location, technology etc., to choose between project designs.

326. In this instance, the locations and lengths of roads have already been chosen by the county and provincial governments, and what is left to consider is the least-cost technology to use in road design. To find the least cost method of constructing these roads given the predetermined objectives and physical locations, four alternative road designs were considered: gravel roads, earth roads, concrete roads and cobble/stone roads.

[79] ROCKS is a World Bank's tool to calculate road infrastructure costs. Download at: http://go.worldbank.org/ZF1I4CJNX0.
RONET is a tool to estimate the budget needs and assess performance of road maintenance Download at: http://go.worldbank.org/A2QQYZNFM0.

327. Project counties were split into three project areas, given varying unit costs depending on geographical locations. The number of beneficiaries per kilometer was kept constant, given that the villages targeted for investments have already been determined. Neither gravel nor earth roads meet the criteria of accessibility or total life of investment in these areas.

328. Out of the remaining two (concrete roads and cobble/stone roads), net present value of investment and O&M costs were calculated in each area. In area A, cobble/stone roads are the least-cost design solution, whereas concrete roads constitute the least cost option in areas B and C. The table below summarizes the designs considered.

**Table 15: Cost-effectiveness Analysis of Rural Road Design**

| | Investment cost (10,000 CNY/km) | O&M cost (10,000 CNY/km per year) | Total life of investment* | Expected accessibility (days/year) | Number of beneficiaries per km | NPV |
|---|---|---|---|---|---|---|
| **Area A** | | | | | | |
| Concrete road | 40 | 0.2500 | 20 | 350 | 200 | (58,414) |
| Cobble/Stone road | 30 | 0.40 | 15 | 320 | 200 | (56,513) |
| **Area B** | | | | | | |
| Concrete road | 50 | 0.3 | 20 | 350 | 150 | (72,097) |
| Cobble/Stone road | 40 | 0.5 | 15 | 320 | 150 | (73,141) |
| Area C | | | | | | |
| Concrete road | 60 | 0.35 | 20 | 350 | 100 | (85,780) |
| Cobble/Stone road | 50 | 0.6 | 15 | 320 | 100 | (89,769) |

*Given adequate Operating and Maintenance

**Table 16: Kalahi-CIDSS Project (WB 2007) Example of survey to value Water Pump System Benefits in a Community Demand Driven Project.**

Province: / Municipality: / Barangay: _____/
Surveyed By/ date: _____

| Benefit as Described in Project | Indicators | Unit | Before | After |
|---|---|---|---|---|
| Time savings in fetching water | Per day and household, average time in minutes that *adults* spend on fetching drinking water | Minutes/day | | |
| | Per day and household, average time in minutes that *children* spend on fetching drinking water | Minutes/ day | | |
| Reduced incidence of waterborne diseases | Per month and household, average number of sick *adult* persons because of waterborne diseases | Days/month | | |
| | Per incidence, average number of days sick and unable to work | Days/incidence | | |
| Increase in water consumption per capita | Per day and household, liters of drinking water consumed per day | Liter/household and day | | |
| Cost savings on water | Cost of drinking water in PHP/ liter | PHP/Liter | | |
| Savings in Operations and Maintenance Cost | Operations and Maintenance Cost per year (PHP) | PHP/ year | | |

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