FINANCIAL ASPECTS OF PROJECT APPRAISAL

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Preface

This Teaching Paper has been developed during and after two lecture series in Project Appraisal for students in the post-graduate Diploma programme at the Department of Rural and Urban Planning. In the course of these series it was felt that there was a genuine need for a short and simple text on the basic elements of financial project appraisal. Although many good textbooks on cost-benefit analysis exist, they invariably take most of the basics for granted and start at a more advanced level of appraisal. This Teaching Paper is intended to fill the perceived gap. It is primarily meant to be a supportive text in the post-graduate teaching programmes at the Department of Rural and Urban Planning, but may also be used in other (shorter) courses dealing with project appraisal. In addition it may serve as a useful reference guide for project planners working at various levels, in various sectors and for various agencies.

Two limitations to this paper need to be mentioned. Firstly, the paper does not explain how to estimate (future) prices of both benefits and costs. This is a field of study in itself and touches on principles of Economics, Valuation and Forecasting. Secondly, the paper is not concerned with 'tricks' and 'manipulations' at the appraisal stage. For readers who are interested in those aspects Gaspers paper (1986) is a recommended reading. Nevertheless, it is hoped that the straightforward nature of the present paper may contribute to a better understanding of the issues involved in the financial appraisal of development projects.

The paper is structured as follows. It first introduces the reader to two case studies from Zimbabwe. These case studies regularly return in the subsequent sections of the paper in order to illustrate some concepts and techniques. The paper then sets project appraisal in its wider project planning context. Section 2 presents a number of basic concepts, that lie at the core of financial project appraisal. The paper subsequently deals with accounting conventions (section 3) and compares the 'normal' or 'business' accounting practice with the one generally adopted in project planning, the cash flow accounting. The next section (4) is called 'time value of money' and explains the concepts of compounding and discounting, as well as the use and application of compounding and discounting tables. Section 5 presents the main indicators of project worth. Both indicators based on 'normal accounting' and those based on 'cash flow accounting' are discussed. Some extensions to the basics of financial appraisal, like sensitivity analysis, are discussed in section 6. A separate section (7) is devoted to cost-effectiveness analysis, as opposed to cost-benefit analysis, which is the dominant method in project appraisal. The last part of the paper (section 8) goes beyond financial appraisal and provides an introduction to economic and social project appraisal as well as to some aspects of project impact assessment.

At the end of the paper a rather extensive bibliography has been added as a guide to further studies. Two useful additions appear in the annexes. The first is a kind of checklist for the writing of a project appraisal report, while the second presents the compounding and discounting tables of 1 - 20%. These tables have been taken from J. Price Gittinger (1973).

This teaching paper has benefitted much from the discussions I had with students at the Department of Rural and Urban Planning. Their views have contributed substantially to the final shape and content of this paper. I am also grateful to Bert Helmsing who commented on an earlier draft. His useful comments did much to improve the quality of the paper. Finally, a word of thanks is due to Joseph Binala who skillfully drew the figures.

1. INTRODUCTION

This first chapter provides the framework for the rest of the paper by introducing the reader to two important aspects. First, it presents the two project case studies that are widely referred to in the other parts of the paper. Second, it shows the nature and scope of project appraisal itself by placing the appraisal stage in the project cycle and by discussing project appraisal criteria.

1.1. Two project case studies from Zimbabwe.

As a leading thread running through this paper two case studies of real life projects from Zimbabwe are presented. Both of them are public sector income generating projects of a recent date. Most of the data relating to those projects and presented in this paper have directly been taken from the relevant appraisal documents, although a few elements have been added or altered for educational purposes. The names and essential characteristics of the proposed projects have been left in tact. The geographical details, however, have been left out.

The first project concerns a District Council agricultural project; henceforth called "Council Fields". In a bid to earn some income for the development of a rather neglected communal land, the District Council secured 50 hectares of land. It proposes to use this land in the 1989/90 agricultural season to grow two crops. Cotton will be grown on 30 hectares, while sunflowers will be cultivated on the remaining land (20 hectares). The land is given to the District Council free of charge and clearing of shrubs and trees has been done in previous years. Initially the Council project officer will organise and coordinate the project, later on a 'manager' may be employed, if it turns out to be a viable venture. Casual labour will be used to perform agricultural activities like planting and weeding, while tractor ploughing and spraying will be done on contract basis. The project will initially run, on a trial basis, for one year. This implies that only the most essential investments in farm equipment are made (wheel barrows, spades etc.), which will amount to Z$ 2000.

The second project is a small town shopping complex, initiated by the centre's town council, which will also be the responsible authority. The shopping complex is proposed to be built in a newly established high density suburb, which lies about 2 km from the main town and is in its last phase of construction. The project consists of the construction of eleven shops and will be implemented in two phases. The first phase will comprise the construction of five shops (2 grocery shops, a butchery, a bottlestore and a hairdressing saloon), while the remaining six shops will be built in the second phase (dry cleaner's shop, fish and chips shop, tailor's shop, another butchery, a supermarket and a doctor's rooms). Ten of the reserved stands for the shops

are 120 m^2, while the one reserved for the supermarket is 480 m^2. The appraisal document further only deals with phase I of the project. The construction of the first five shops is expected to take 6 months. After this period it is assumed that the shops will immediately be rented to businessmen. The life of the project is set for 25 years.

1.2. The Framework for Project Appraisal

Project appraisal is a critical step in project planning. Once a project is identified and its technical, economic and organisational aspects have been formulated in more detail, its feasibility needs to be appraised. In terms of the project planning and management cycle, project appraisal is the last step before a project will be selected and activated (see figure 1). As such it is the culmination of the other preparatory stages in the project cycle, providing a thorough review of all aspects involved in the proposed project.

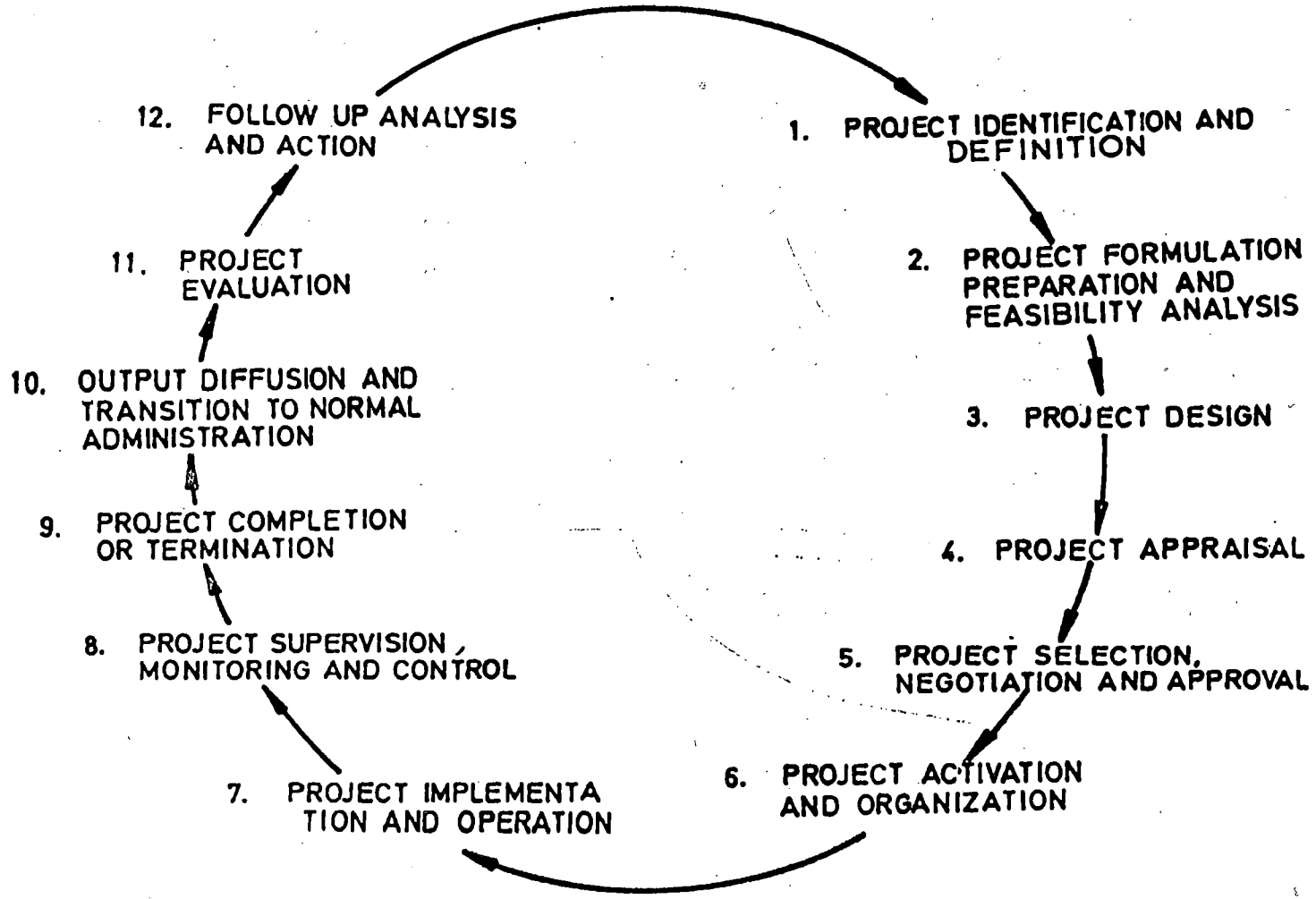
The appraisal will form the basis for decision-making with respect to the next stages of the project planning cycle. It can tell the decision-maker whether the project will be acceptable or not, under which conditions this is the case, whether changes need to be made in its design etc. A positive overall appraisal will normally result in the next steps: approval and implementation of the project. A more critical advice may result in a reformulation of the project or a rejection of the proposal in its original form. The appraisal report will also be a useful document for project monitoring and (mid-term) evaluation, as it provides a yardstick for the actual project performance.

From the many linkages of project appraisal to the other stages in the project cycle it will be clear that a thorough appraisal is an essential input in project planning. But how to do such a thorough appraisal? And what are the appraisal criteria or yardsticks to apply?

In dealing with appraisal criteria one generally makes a distinction between "extended" and "narrow or normal" criteria. The former refers to the relation of a project with overall policy issues in a country or region, while the latter is concerned with the internal characteristics of a project. Extended appraisal criteria are used to find out whether a project is in line with government policy, both at the national and the regional level. It typically raises questions like whether the project is in a field of priority of the government, whether it is capital or labour intensive, what type of technology it makes use of and whether it uses, saves or earns foreign exchange. Extended appraisal criteria are, however, not the focus of this paper and will not be dealt with further here. The "narrow" or "normal" appraisal criteria are described in more depth below. These criteria refer to yardsticks that are more or less universal and can be applied regardless of the policy

Fig.1.

PROJECT PLANNING AND MANAGEMENT CYCLE



Source: Dennis A. Rondinelli and Aspy Patia Project Planning and Implementation in Developing Countries: A Bibliography on Development Project Management, East West Center, Honolulu, Hawaii 1976 p. xvi.

environment. Wherever in the following "appraisal" or "appraisal criteria" are mentioned, their meaning refers to what has been called before "normal or narrow appraisal (criteria)".

A project appraisal document will not only focus on financial and/or economic aspects, but also on its technical and organisational feasibility. Baum (1982) distinguishes four major aspects of project appraisal: technical, institutional, economic and financial. To this I like to add a fifth, viz. project impacts or project effects. This makes the following five fields of appraisal of central concern to a project analyst:

1. Technical Appraisal. Technical appraisal is primarily concerned with questions of design and engineering. It should assert that the proposed project alternative is soundly designed and engineered; that it is appropriate for local conditions; and that it sticks to legal and technical standards. The analyst will a.o. assess the proposed alternative on type of technology or equipment used; type of approach followed (e.g. in education or health projects); and type, location and dimensions of physical infrastructure. He will also consider how realistic time/implementation schedules and proposed output levels are and whether the costing is reliable. In larger and more complicated projects technical appraisal is foremost a matter of technical experts (engineers, architects, physical planners etc.), but in smaller projects the analyst will have to rely on his own judgement, probably with some outside advice.

2. Institutional Appraisal. This aspect of project appraisal is concerned with issues of organisation, management and policy. It not only covers the project institution itself and "its organisation, management, staffing, policies and procedures, but also the whole array of government policies that conditions the environment in which the institution operates" (Baum, 1982, 12). A proper institutional appraisal is of vital importance to the success of any project. However, there are no universally acceptable institutional appraisal criteria. This is partly due to the fact that different types of projects require different set-ups and partly to the variations in political, cultural and economic project environments. An institutional appraisal can therefore never be of a "blueprint-type" and will always carry a high degree of personal (expert) value judgement.

3. Financial Appraisal. Financial appraisal is concerned with the viability, efficiency and/or effectiveness of a project. The <u>viability-aspect</u> can be further subdivided into 'profitability' and 'liquidity'. The former indicates whether in a project expected benefits (revenues) will exceed expected costs, while the latter deals with the question whether there will be sufficient funds available over the lifetime of the project to cover investment and operating costs. A market or demand study is normally an integral part of viability analysis. The <u>efficiency-aspect</u>

in principle tells how efficient inputs (or costs) are transferred into outputs (or benefits). It goes further on the profitability aspect above and intends to facilitate selection among viable alternatives. Cost-Benefit Analysis is the central technique developed to tell the extent to which benefits outnumber costs, or in other words: the degree of profitability or efficiency of a project. The last aspect of financial appraisal, effectiveness, either supplements or substitutes the efficiency aspect. It is concerned with the question whether the inputs chosen for a project are (sufficiently) effective to reach the stated aims or goals. Its main techniques, cost-effectiveness analysis, can specifically be applied where benefits of a project are hard or impossible to valuate.

4. Economic and Social Appraisal. Where financial project appraisal is confined to the costs and benefits as experienced by the project as such, economic and social appraisal widens the scope. It is concerned with the projects' contribution to the development objectives of the country at large. These can be many: growth in national income, a fairer income distribution, increased job creation, education for all, an improved health situation etc. However, from among these objectives economic appraisal selects maximisation of national income as the central objective and measures how much a project contributes to this goal. Social appraisal then goes one step further and also takes some other, sometimes more value loaded objectives into account (effects on income distribution, savings versus consumption, merit versus de-merit goods).

5. Project Impact Assessment. Although economic and social appraisal look at project effects from the viewpoint of the nation, they do so only to the extent that these effects can be expressed in terms of (monetary) benefits and costs. Projects, however, may have many impacts that can never be properly valued. Social and environmental impacts are a point in case. How does one value a (forced) change in life-style of a social group that is affected by a project? Or how to valuate air pollution? Impacts of these kinds do occur, but will normally not be taken into account by economic or social appraisal. "Impacts" in this respect refers to those changes that will occur because of the implementation of a project. In other words, they are project specific and they are not likely to occur anyway.

The first two aspects of project appraisal mentioned above are rather project specific, while the latter two are quite complicated and show many difficulties. In any case, all aspects deserve extensive treatment and require a lengthy paper to be fully covered. This paper will primarily be devoted to financial project appraisal, but will also give a short introduction to economic and social project appraisal and impact assessment (section 8).

Several standard techniques for the financial and economic

analysis of projects have been developed, that can be applied in the appraisal stage. As mentioned earlier, the most prominent technique is Cost-Benefit Analysis. Cost-Benefit Analysis starts with the identification, specification and valuation of all expected effects of a project. Subsequently it is established whether these effects will be costs or benefits in any case to the project, but sometimes also to the government and/or to the nation at large (economic and social appraisal). Finally, measures of project worth will be calculated to express the value of the project and to state whether it will be wise to invest in the project or not. These steps sound rather simple and in principle they are. In practice however many tricky elements may be involved. Some effects may, for instance be very hard to specify, like social or environmental project effects, or prove very hard to quantify, like the improved quality of education, let alone to value. In cases where too many items -especially benefits- are hard to express in money terms, Cost-Effectiveness Analysis may prove to be a good alternative to Cost-Benefit Analysis (see section 7).

As an appraisal technique Cost-Benefit Analysis has many advantages. It provides a uniform methodology in project analysis, facilitating comparisons between projects. It requires systematic work and a thorough reflection on all the probable effects of a project, implying that no major financial or economic 'surprise' is likely to occur. It makes it possible to identify problems in the liquidity position at certain stages of a project in advance. And, last but not least, it gives an indication of the profitability and efficiency of a project and its contribution to the national income or to other national objectives, thereby providing a yardstick for approval and selection. On the other hand a few limitations should be kept in mind. These refer to the fact that in some projects benefits and costs may be hard to assess, as was already mentioned, and to the fact that decisions regarding projects rarely can be taken on the basis of Cost-Benefit Analysis alone. Technical, organisational and political recommendations will normally supplement the financial and/or economic appraisal.

Up till now the words 'financial' and 'economic' have been used without proper clarification of their meaning in project appraisal. The difference between the two lies in the point of view one takes when appraising a project. Financial analysis is concerned with the private point of view, or in other words: the appraisal reflects the interest of the promoters or the owners of a project. This implies that only those effects are accounted for that are felt by the project and that prices are used as experienced by the project, i.e. the prices that occur on the market place. In economic analysis on the other hand, the appraisal is carried out from the point of view of society at large. This, among others, indicates a change from market prices to scarcity or accounting prices. It also implies that effects that occur outside the strict confines of the project must be taken into account. These and other differences between financial and economic appraisal are elaborated in section 8.

2. SOME BASIC CONCEPTS.

2.1. Benefits and Revenue.

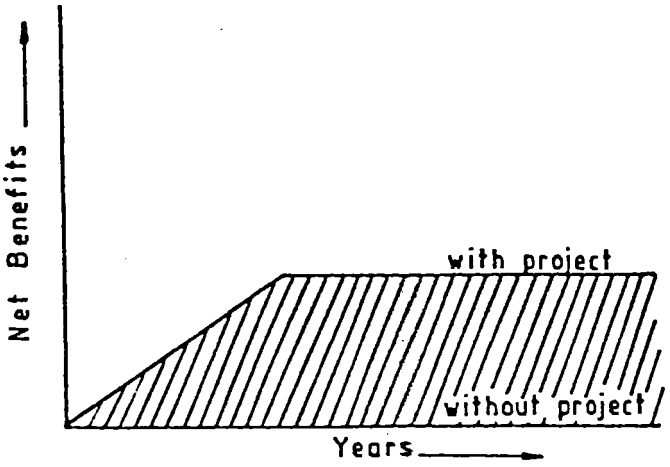
The revenue of an activity or project can be defined as the incoming flow of money originating from sales of (project) output in a year of operation. In both business and project accounting revenue will normally be expressed on an annual basis, coinciding with the financial year for the business or project. Usually (gross) benefits are defined in the same way as revenue. A multiplication of expected sales volume and expected prices will give the revenue a project is likely to generate. In the Council Fields project, for instance, one expected 6 bales of cotton (200 kg per bale) to be produced from one hectare and a selling price of 84 cents per kg (grade C cotton). This would generate a revenue of 6 x 30 x 200 x 84 cents = Z$ 30240.00 for the next project year.

Output need not necessarily be sold to be a revenue; it can also be home-consumed. In that case the value of the revenue can be determined by multiplying the volume of home consumption by the prices for the same items on the local market. A decrease in stock due to selling of certain items can also be regarded as revenue.
Note that an increase in the value of an asset (e.g. repairing a piece of equipment) is not a revenue as long as it is not an activity that is either sold or (home-) consumed.

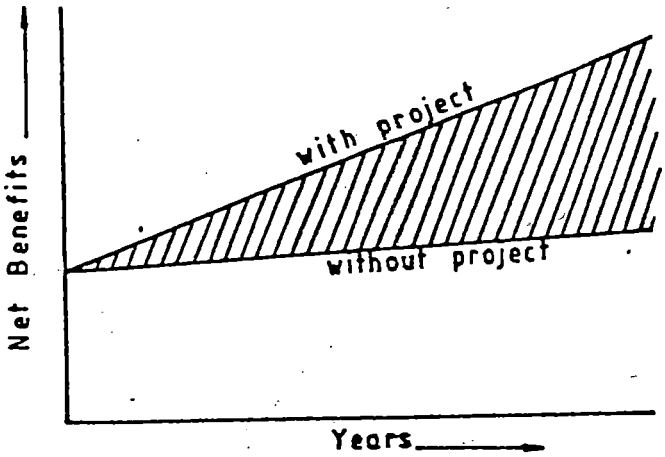
In project accounting, the term 'net benefits' refers to the amount remaining after all outflows of money (costs) are subtracted from all inflows (revenues). Subtracting all outflows from all inflows results in the net cash flow; subtracting only the operating costs from the revenues derives the net operating benefit (see section 3). The net benefits may be negative, especially in the earlier years of a project.

Finally, (net) incremental benefits can be defined as the increase in (net) benefits with the project as opposed to the case without the project (= (net) incremental cash flow). The outcome, again, is usually negative in the early years of the project. The "with-without" difference represents the net incremental benefits arising from the project investment, or in other words the financial effects that are directly attributable to the project. The "with-without" comparison is not the same as the "before-after" comparison, although in some cases it may well be (when no production occurs without the project, like in the Council Fields project for instance). Normally, however, output in a project, enterprise or area is either growing or declining. This trend should be taken into account by the project analyst when determining the (net) incremental benefits. The net incremental benefits (net cash flow) forms the basis for the calculation of financial indicators like the NPV and the IRR (see section 5).

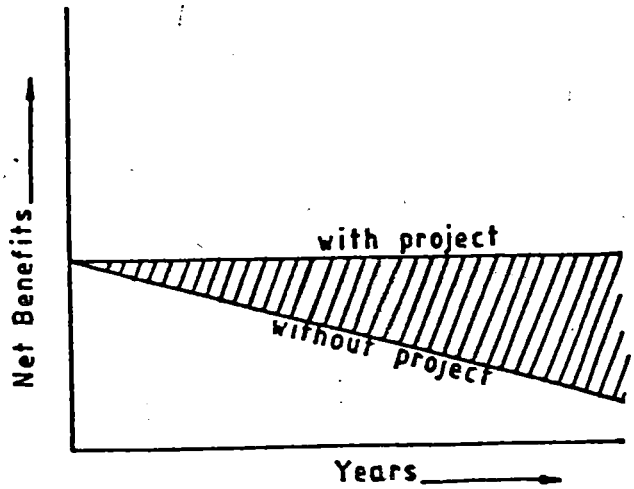
Figure 2 NET BENEFITS AND NET INCREMENTAL BENEFITS (Some graphical examples)



a. A project as a completely new activity



b. A project increasing an already growing stream of net benefits



c. A project avoiding a loss of net benefits

Legend

Net incremental benefits for a project

In most publications on project appraisal authors use the concepts 'benefits' or 'net benefits', when they actually mean 'incremental benefits' or 'net incremental benefits', leading to some confusion around the concepts. It should be borne in mind, however, that the (net) incremental benefits is the correct concept to apply in project appraisal. Figure 2 provides a graphical presentation of this concept.

Net incremental benefits are monetary effects that are directly attributable to the project. They may be the result of an increase in output (more sales than before) and/or an improvement in quality (leading to a higher price). Alternatively they can be due to a change in the time of sales (e.g. storage project), of a change in the location of sales (e.g. transportation project), or of a change in product form (e.g. grading or processing). In the last three cases, the benefits will presumably be expressed in a higher price for the product produced. Finally, benefits may be caused by cost reductions and/or to losses avoided (e.g. increase in efficiency).

It should be noted here that benefits exist in many forms and sorts. Clearly, an improved health situation due to a series of District Water supply projects is a benefit to the people living there. Likewise can a road improvement project contribute to more safety and less accidents on the road, which also is definitely a benefit to the users. But the problem is how to valuate these benefits. This is virtually impossible and in project appraisal these kinds of project effects have obtained the name intangible benefits. They can not be expressed in monetary terms and will consequently not enter the financial or economic analysis. Nevertheless they should be taken into account when appraising the project. The importance attached to them may support the outcome of the formal (financial) appraisal, or alternatively outweigh these results, persuading decision-makers to act against the financial appraisal alone.

2.2. Costs.

The costs of a project are expenses made in order to reach the project objectives. This definition implies that costs are in fact incremental costs and are the result of the project activities. Consequently, costs that would have occurred regardless of the project should not be included in the project analysis. An example is the salary of the "project manager" in the Council Fields project. He would have been employed and paid by the Council anyway, so his salary can not be seen as a project specific cost.
Various different types of costs can be distinguished: investment costs; costs from operations (both fixed and variable costs); and costs that relate to the financing of the project (repayment of loan, interest payment, payment of dividends; see section 2.8). Depreciation charges are a special case. In business accounting they are seen as costs as every year a certain amount of money is set aside for replacement of capital items. In project

accounting on the other hand, depreciation charges do not appear as costs as income and expenditure are strictly recorded at the moment they actually occur. The principles of depreciation are further outlined in section 2.3. below.

Investment costs or capital costs are expenditures on capital items like factories, machines, land, vehicles etc. The costs of construction of the shopping complex in the project of the small town city council provides a good example. Site preparation and construction are also included in the investment costs, just like other pre-production costs. The latter refers to non recoverable expenditures made in the preparation of a project. Examples are pre-project studies, consultancies and technical advice. Working capital can also be seen as a capital cost. It covers costs for sufficient stocks, spares and cash in order to pay bills ahead of receipts (Commonwealth Secretariat, 1982). It is important to reserve funds for these items, as one might need quite large amounts of stocks or spares in order for a project to operate smoothly. Working capital is usually presented as the last item in the investment cost section, just before operating expenses. Sometimes separately mentioned, but in principle the same as working capital are the initial working capital requirements. The latter can be defined as a sum of money required to finance the first day to day operations of a project, until revenue is sufficient to cover the expenses. The initial working capital includes (a number of) monthly cash payments and items that have to be paid in advance in the first year, like rent or insurance. Tax can be excluded as it is normally paid at the end of a year. The initial working capital requirements can also be regarded as an investment cost.

Operating costs are costs incurred once a project is underway. It refers to expenditures on goods and services which are used up in the production process. Examples are: costs of raw materials, fuel, water, labour, transport, maintenance and repairs. Operating costs are of two kinds: fixed and variable. Fixed costs are costs that hardly change with the volume of production like maintenance, administration and management charges. In cost estimates for a project they appear usually as annual constant amounts. Variable costs on the other hand are costs that vary directly with the volume of production. They relate to the costs of variable inputs like raw materials, labour, energy and transport. Wastage of inputs and products that can not be used or sold due to damages, can also be included in the variable costs.

Special attention needs to be paid to contingency allowances. These refer to amounts included in the project accounts at the planning stage to "allow for adverse conditions that will add to baseline costs" (Price Gittinger, 1982). Contingencies can be of two kinds: physical contingencies and price contingencies. The former points at money set aside for situations when more raw materials or labour or fuel etc. may be needed, due to unforeseen circumstances. This is normally added to the costs of an item to which it relates. Physical contingencies also refer to the combination of cost items that are too small or insignificant to

be included separately. A lump sum figure is used instead, which is usually taken as a fixed percentage of the total capital costs (5% - 10%, depending on the type of project). Price contingencies, on the other hand, allow for general or specific cost increases. If the appraisal is done in constant prices, this effect is omitted from the accounts (see also section 2.5.). Only when certain items are very likely to change in price differently from the general rate of inflation, one is allowed to take price contingencies into account.

2.3. Depreciation.

Depreciation is an accounting convention that can be seen as a fund of money set aside for replacement of fixed assets (see section 3). Each year of the useful life of an asset a part or proportion of its total value is written off, the balance representing its book value at the end of a financial year. 'Useful life' refers to the period an asset operates efficiently and implies that an asset is replaced when an alternative asset is more profitable. Depreciation then can be seen as an amount of money set aside for the replacement of those items that eventually come to the end of a 'useful life', like machines. An asset like land can be depreciated when it is 'mined', but no charge is needed as long as the use does not effect its output potential. In the Council Field example the 50 hectares of land can be seen as a fixed asset, but when cultivated properly, they will not loose their value. No depreciation therefore will be entered in the accounts. Depreciation charges will normally be debited to the income statement and credited to a provision account.

Reasons for depreciation are:

(1) normal physical wear and tear through friction, heating or chemical change. Generally, as a fixed asset becomes older, more costs will arise on repairs, maintenance and replacements. Therefore depreciation charges tend to be higher in the first years of a project to balance the repair/replacement/maintenance costs of the later years.

(2) a decline in value people tend to be prepared to pay for goods of some age. This is another reason for higher depreciation charges in the first years of a project as the market value normally declines rapidly in the first few years.

(3) the probability of accidental damages or excessive wear and tear.

(4) technological progress, which tends to make assets (especially machines) antiquated long before they are physically worn out.

It should be kept in mind that depreciation is not a financial transaction between a project and the outside world and therefore does not show in the cash flow statement. And as the cash flow statement is the basis for most project appraisal, depreciation can normally be excluded at this stage in the project cycle.

Nevertheless it is a useful concept in project planning, especially in the implementation phase, while for a few measures of project worth depreciation should also be accounted for (see section 5). Depreciation can be regarded as an annual cost and therefore does appear in the income statement. Use of depreciation in accounting normally has the advantage of reducing tax liability as taxation in many countries takes place on the basis of profit after depreciation has been deducted. Allowance may be made for the resale value of the fixed asset (or residual or salvage value) at the end of its useful life to the project. The amount to be depreciated then is the difference between the original value and the resale value.

There are several methods of depreciation:

a. the straight-line method: spreading the depreciation charges over the estimated life of the assets in equal yearly installments. This method is also referred to as the 'proportional method' or the 'equal installment method' and is the most common one in project appraisal. The basic assumption underlying this method is that a fixed asset wears out in a gradual manner over its useful life. To calculate the charges one needs to know (1) the useful life of the asset in years (2) its original value and (3) its resale value at the end of its useful life. The yearly amount is simply calculated by dividing the original cost of an asset (minus the resale value) by its life span.

b. production based method: the depreciation charge is related to output figures. This method is used when production varies from one year to another and can be expressed in units of production or in production time (hours/days). It can be calculated:
   * in units: value of asset/no. of units of production in the useful life. This will give the depreciation per unit of production.
   * in time: value of asset/no. of production hours/days over the useful life. This will give the depreciation per hour/day of operation.

   Note again that the value of the asset refers to the original costs minus the resale value.

c. declining balance method: each year a fixed percentage of the book value of an asset is depreciated. This is a logical method when -as happens in many cases- the greatest loss in value occurs in the first few years. It should be noted that in this method the depreciation charge declines each year by a smaller amount and that a residual book value will appear at the end of the life of an asset.

d. sum-of-the-years-digits method: the depreciation charge declines each year by a fixed amount. In the earlier years of the assets life the depreciation values are higher than in the later years. In that sense it resembles the declining balance method, but in this case there is no residual book value at the end of the life of an asset. To find the

depreciation charge one first adds up the total number of years of the assets useful life (for 4 years this will give 1+2+3+4=10). The number of years an asset is still expected to be used is divided by this figure to find the depreciation charge (in the above example this means 4 years in year one giving a depreciation charge of 4/10th of the original value in year 1, 3/10th in years 2 etc.).

Alternatively, two formulas can be used when determining the depreciation charges:
* to find the depreciation charge for the first year: $2D/(n+1)$
* to find the amount the depreciation charge declines in subsequent years: $2D/n(n+1)$

where D = initial cost of asset minus resale value
and n = expected life of the asset

The following hypothetical example may clarify the methods presented above. Suppose an asset (machine) is bought for $10.000 and has an expected life of 10 years, after which no residual value will occur. Production figures are:

year 1	:	25 units
" 2	:	50 units
" 3	:	75 units
" 4	:	100 units
" 5-10	:	125 units
total	:	1000 units

Method a: value of asset/life of asset = 10000/10 = $ 1000 per year.

Method b: value of asset/no of units produced = $ 10 per unit. This gives the following charges:

year 1	: $ 250	year 4	: $ 1000
year 2	: $ 500	year 5-10	: $ 1250
year 3	: $ 750		

Method c: based on an annual depreciation value of 20% the charges and residual value will be:

year	depreciation	value at end of year
1	$ 2000	$ 8000
2	$ 1600	$ 6400
3	$ 1280	$ 5120
4	$ 1024	$ 4096
5	$ 819	$ 3277
6	$ 655	$ 2622
7	$ 524	$ 2098
8	$ 420	$ 1678
9	$ 336	$ 1342
10	$ 268	$ 1074

Figure 3 DEPRECIATION CHARGES FOR A SAMPLE PROJECT USING SEVERAL DEPRECIATION METHODS

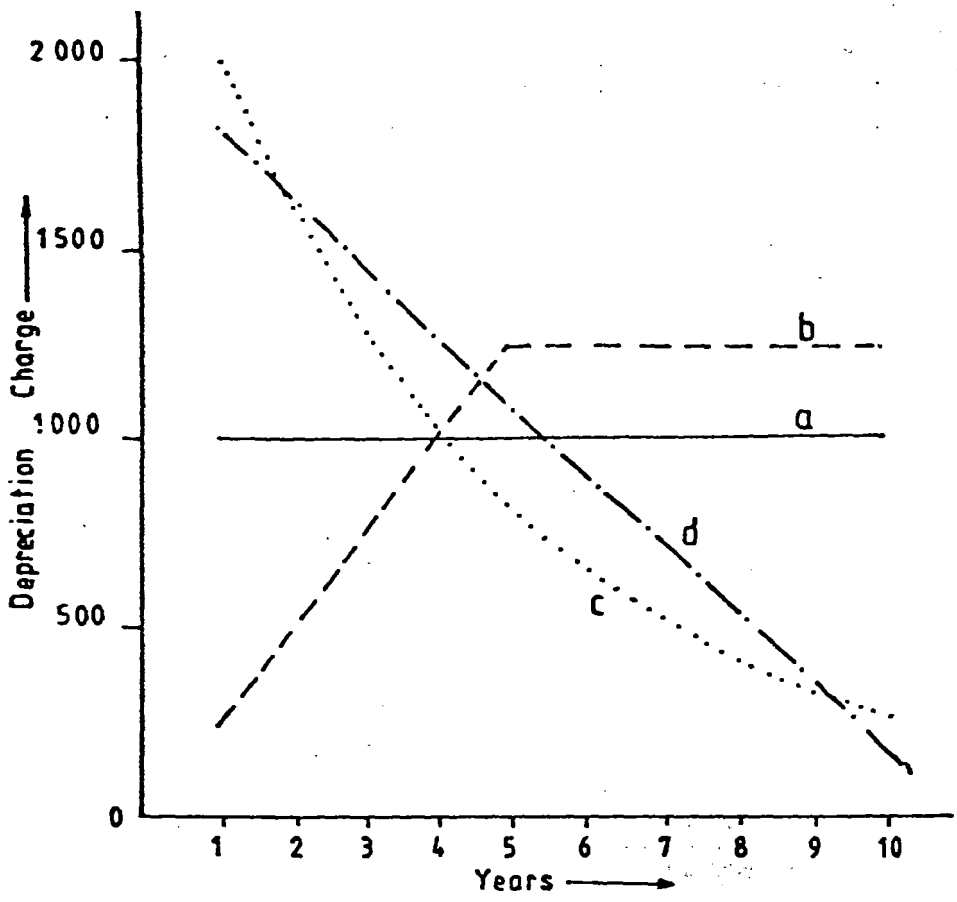
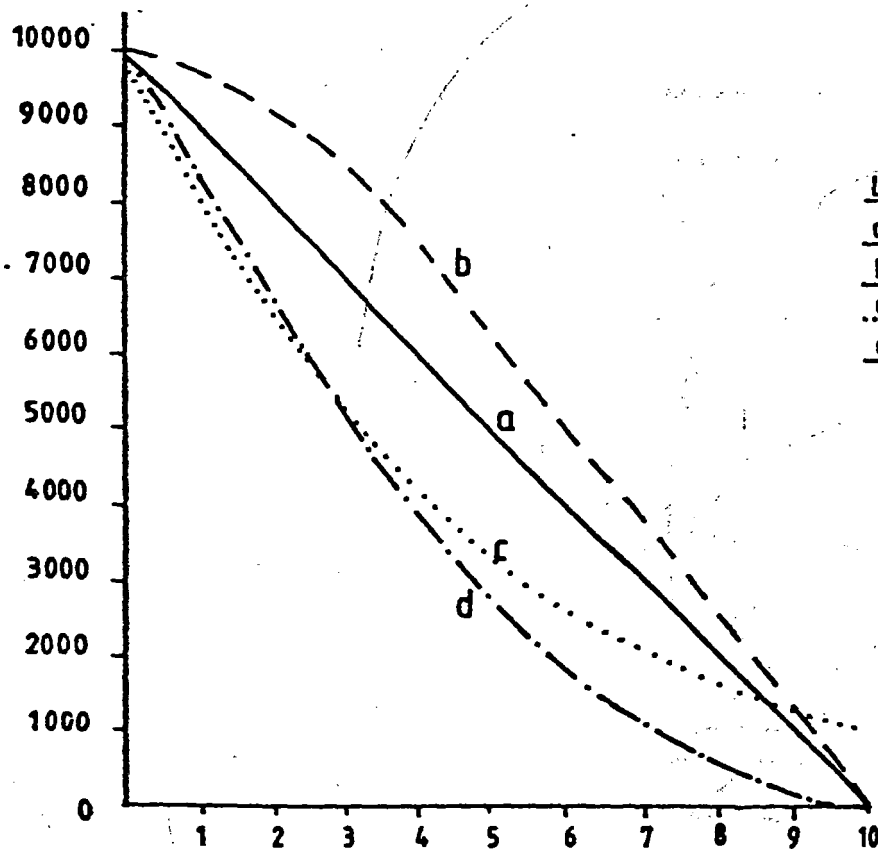


Figure 4 RESIDUAL VALUE FOR A SAMPLE PROJECT USING SEVERAL DEPRECIATION METHODS



Legend Fig 2+3

a = straight line method
b = production based method
c = declining balance method
d = sum of the years digit method

Method d: sum of the years digit = 1+2+...+10= 55.

year	charge	depreciation	value at end of year
1	10/55	$ 1818	$ 8182
2	9/55	$ 1636	$ 6546
3	8/55	$ 1455	$ 5091
4	7/55	$ 1273	$ 3818
5	6/55	$ 1091	$ 2727
6	5/55	$ 909	$ 1818
7	4/55	$ 727	$ 1091
8	3/55	$ 545	$ 546
9	2/55	$ 364	$ 182
10	1/55	$ 182	$ 0

The outcomes of the various methods over the years are graphically presented in figures 3 and 4.

2.4. Financing of Projects.

Financing is a rather neglected area in project analysis. Alternative ways of financing are not unfrequently overlooked and a thorough comparison of various options to finance a project is rarely made. Nevertheless, it makes a great difference whether a project is financed through equity capital or through borrowing and on what terms. The attractiveness of a loan will be influenced enormously by variations in repayment period and interest rates. Nevertheless, project appraisal usually happens in the absence of information on the way it is financed or on the basis of an agreed and fixed financing schedule.

One way of financing a project or enterprise is through the issuing of shares to obtain equity capital. Share holders put in their money to become 'owners' of the project or enterprise. If a project is profitable, that is when the revenues exceed the costs of operation, depreciation, interest payment, repayment of loan and interest payment, then one can decide to make dividend payments. The rate of dividend payment relative to equity determines the attractiveness of a project to share holders.

However, in most projects a substantial loan element is included in order to finance the projects investments. Loans can be agreed upon by lender and borrower on a wide range of conditions, but the essential characteristic of a loan is that it finally must be repaid to the lending institution. Interest payment on the outstanding debt is usually added. All loans have a nominal interest rate, i.e. the rate at which the loan was agreed. This may be at the market rate of interest in the case of a commercial loan, or at a lower rate when a grant element is included (soft loan). Interest is usually expressed as a percentage of the outstanding debt (= initial loan minus repayments made). The period in which the borrowed amount must be repaid is called the repayment period. Repayment of the loan may start immediately, after some years (grace period), or may be made all at once at the final date of a project (bullet loan). During a grace period interest may or may not be paid, or alternatively it may be added to the outstanding debt. The cost of making payments on a loan

(repayment and/or interest payment) is called debt service.

A project does not always need to borrow all the money involved at once. An agreement between lender and borrower may allow the borrower to draw down a loan over a period of time. Consequently, interest payments are lower over this period than in case of a total disbursement at the beginning of a project. As the lender is obliged to keep the undisbursed portion of the loan available, a commitment fee usually is charged to the borrower over this portion.

A useful reference for further studies of project finance, including alternative ways of financing development projects and their impacts on project performance, is Harvey (1983).

2.5. Constant or Current Prices?

A special note needs to be made concerning the prices costs and benefits are expressed in. In project appraisal one usually applies constant (today's) prices, which implies that inflation will not be accounted for. Future prices will be assumed to equal those at present. As long as inflation is generally the same for all items in the appraisal, this is perfectly acceptable. If it is not, then adjustments need to be made for the prices of those items that are expected to increase at a relatively lower or higher rate than the general rate of inflation. That is, if prices for a cost item (e.g. energy) are likely to rise faster than the general price increase in the country (inflation) one will have to reflect this additional rise in the (constant) prices of the item in question over the project life.

In some cases it may also be useful to present the appraisal in current prices. Especially for budget estimations it may be necessary to know what the actual amounts of income and expenditure will be at a certain moment in time.

One can also appraise a project in current prices, but then one needs to estimate the rate of inflation and add it[1] to the discount rate before discounting (see section 4). Again, this can only be done when inflation will affect costs and benefits in an equal manner. If this is not the case -and it is usually very

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[1] In fact, one should not add the rate of inflation to the discount rate, but use the following formula:

(1 + discount rate at constant prices) (1 + rate of inflation) = (1+ discount rate at current prices)

For instance, if the discount rate is 10% and the general rate of inflation equals 8%, the rate to be used for discounting current prices will be:

$(1 + 0.10)\ (1 + 0.08) = (1 + x)$

$x = [1.10 * 1.08] - 1$

$= 1.188 - 1$

$= 0.188$ or 18.8%

unlikely that all items in the appraisal will face a similar rate of inflation- then one has to adjust the prices of the items that show a different inflation rate in the same way as described above. However, the use of constant prices remains preferable in project appraisal and is generally accepted as a standard convention.

2.6. Project life

An essential characteristic of a project is that its life is limited. This is true for every conceivable project, although some show a rather long lifetime (e.g. dam construction projects). In financial appraisal the project life is primarily determined by two factors: the life of its main asset and/or the use of discounting in the appraisal.

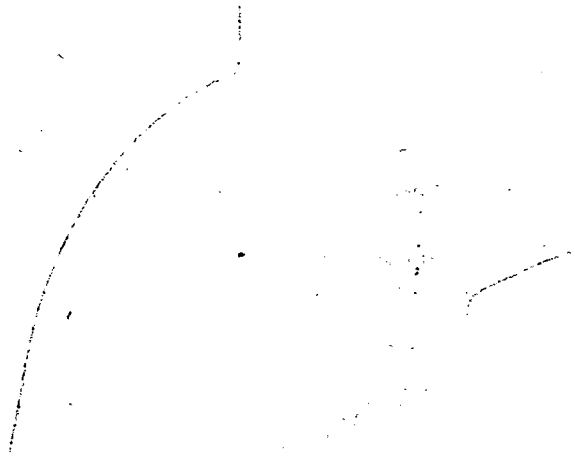
A distinction needs to be made between physical and economic life of an asset. The economic life is the period that it is worthwhile (on financial grounds) to use a certain asset. This can very well be shorter than the physical life of the asset, as for several reasons it might be better to purchase a new asset long before it is actually worn out. Technological progress, for instance may cause the economic life of an asset (e.g. computer) to be much shorter than its physical life. Alternatively, the physical life of an asset may be prolonged by maintenance and repair, but at a certain point in time this will cease to be economic. It is this economic life of an asset that is applied in project appraisal.

Where the life of a project is determined by the life of its main assets, we might also have to deal with assets of a shorter life. These assets will have to be replaced once or more during the project life and costs for these replacements will have to enter the project accounts as costs. Some assets, on the other hand, will have a life longer than the project. These items will still have a value at the end of the project -the same may happen to short life assets that have been replaced during the project- and also have to enter the project accounts, but this time as benefits. It is a convention that this type of benefits, accruing out of the salvage value of assets, will be recorded in the year after the project ends. In the case study of the shopping complex, for example, the life of the project is 25 years. If it were found that the complex would have a residual value after this period, this amount would be recorded in year 26.

It is not common that one encounters a project with a life longer than 25 years. The reason for this lies in the second factor determining a projects life, the technique of discounting. Many measures of project worth use discounting as a technique to adjust the future worth of costs and benefits (see section 5). The further away a cost or benefit item is recorded in the life of a project, the heavier will its worth be reduced by discounting. One finds that discounted costs and benefits that will occur about 25 to 30 years from now are rather negligible

as compared to the worth of the same items at the present moment. Moreover, the further away costs and benefits arise in the future, the more uncertain they are. For appraisal purposes it is therefore common to limit the life of a project to 25 years (Commonwealth Secretariat, 1982).

There are two ways to number the years of a project. In some cases the numbering of the years starts from year 0; in others from year 1. For the outcome of the appraisal it does not matter which manner is applied, as long as it is done consistently. In this paper the World Bank convention will be followed, which starts with year 0 as the first year of the project. It is seen as the period (it may be much shorter than one year) in which the main investment costs are made. The first year of operation then, is taken as year 1. This is a very convenient convention for depreciation purposes as will be seen in section 4.



3. FINANCIAL STATEMENTS.

Both at the planning stages of a project (feasibility, appraisal) and during implementation, the project analyst is likely to encounter various financial statements. In this section the main ones are presented: the income statement (3.1.) and the balance sheet (3.2.), which are commonly used in 'normal' or 'business' accounting, and the cash flow statement (3.3.), which forms the basis for 'project' or 'cash flow' accounting.

The format and layout of these three statements may differ substantially between projects and countries, although their purpose is broadly the same. For various reasons will it be useful to adopt one format for the entire life of a project. This will facilitate the execution and monitoring of the project. It will also help accountants or evaluators to make a comparison between intention (ex-ante or planned accounts) and result (ex-post or actual accounts).

3.1. The Income Statement.

The income statement is a report summarising all revenues and all expenses of an enterprise during an accounting period (financial year). Other names for this statement are: income and expenditure statement, revenue account, and profit and loss account. The statement lists income and expenses due to operations to show whether an enterprise was profitable or not in a financial year. For project appraisal it is usually presented over the lifetime of the project, so as to give a cinematic picture of revenues and expenses over time. Table 1 provides an outlay for an income statement as it is normally presented in project accounting. The same information is graphically depicted in figure 5. Note that investments do not appear in the income statement as the statement is concerned with the results of investments only. Depreciation is included as it is a capital charge to those investments. Interest payments are also included as this item represents the actual costs of a loan -used for the operation of a project- over the years. All other forms of finance capital (equity, loans, repayment) are omitted from this statement as they do not follow from the result of the operations of an enterprise or project, but rather point at the way it was financed.

Table 1. Sample layout of an income statement.

item	year 1	2	3	4	5	6	etc.
1. Revenue							
2. Operating expenses (fixed + variable)							
3. Gross Operating Profit (=1-2)							
4. Depreciation							
5. Net Operating Profit (=3-4)							
6. Interest Charges							
7. Net Profit before Tax (=5-6)							
8. Direct Taxes							
9. Net Profit after Tax (=7-8)							
10. Dividend Payments							
11. Retained Earnings (=9-10)							

The income statement starts with the revenue from operations. This may include the money value of goods sold (or home consumed), of services rendered and/or of interest received from money lent to others. Goods that are produced, but not (yet) sold do not enter the income statement, but appear on the balance sheet as they do not represent an income, but an asset.

Next come the various costs that are made in the accounting period under consideration. These exclude the investment costs, which are normally incurred before operations started. It also excludes a (small) part of the variable costs, viz. those costs of raw materials, labour, energy etc. that are embodied in the stock of goods left unsold at the end of the accounting period. According to the "matching principle" in accountancy one should match the product revenues and costs for a specific period. Like the revenues, the costs made for the items in stock may appear on the income statement of a subsequent financial year.

The difference between revenues and operating costs provides the gross operating profit. To find the net operating profit one also has to deduct the depreciation charges. After allowance for interest payments the net profit before tax follows.

A company usually is taxed on the 'net profit before taxation'. This refers to the profit after the allowances described above have been made, but before dividends are paid to share-holders. Company tax differs from country to country and also varies between different types of enterprises. Not all projects will be liable to company tax. Income generating projects are likely to be taxed; projects in the fields of education, health etc. usually not. Although tax is not a real cost, as it is not (directly) linked to the operation of the project, it is an expenditure to a project and may therefore appear in the income statement. It is to be regarded as that part of the profit, which is taken by government.
Retained earnings or undisbursed profits represent the amount of money which is available to the project in a year of operation

after all costs (including depreciation and interest payments) have been accounted for and after government has taken its share (direct or company tax). In other words: it is that amount of money that is really left to the project. The project management is more or less free to decide upon its use. For accounting purposes the retained earnings in a certain year of operation will be added to the reserves of a project or enterprise.

The income statement of the Council Fields project is presented in table 2. It is not a typical project income statement as several items do not appear. No capital costs were involved and consequently no depreciation has to be accounted for. The cost items in the original document were presented in detail, as it should in an appraisal document, but for convenience sake they have been depicted in rather aggregate form here.

Table 2. Income statement of Council Fields project.

Revenue	- sale of cotton	30240.00	
	- refund of cotton bales	990.00	
	- sale of sunflower	22800.00	
	- refund for sunflower bags	660.00	
Total Revenue			54690.00
Operating costs:			
cotton:	- fertilizer	2088.00	
	- land ploughing	3200.00	
	- pesticides	709.00	
	- casual labour wages	1638.00	
	- spraying	1200.00	
	- cotton picking	2880.00	
	- purchase of cotton bales	1080.00	
	- cotton bailing	327.60	
	- transport to CMB depot	1710.00	
sunflower:	- fertilizer	1352.00	
	- land ploughing	2000.00	
	- casual labour	790.00	
	- harvesting costs	694.00	
	- packing of bags	1110.00	
	- transport to CMB	1650.00	
Total Costs			22428.00
Profit before taxation			32262.00

At a first glance at the statement above it will already be clear that this activity is likely to be an extremely profitable venture.

FIGURE 5 SCHEMATIC PRESENTATION OF AN INCOME STATEMENT

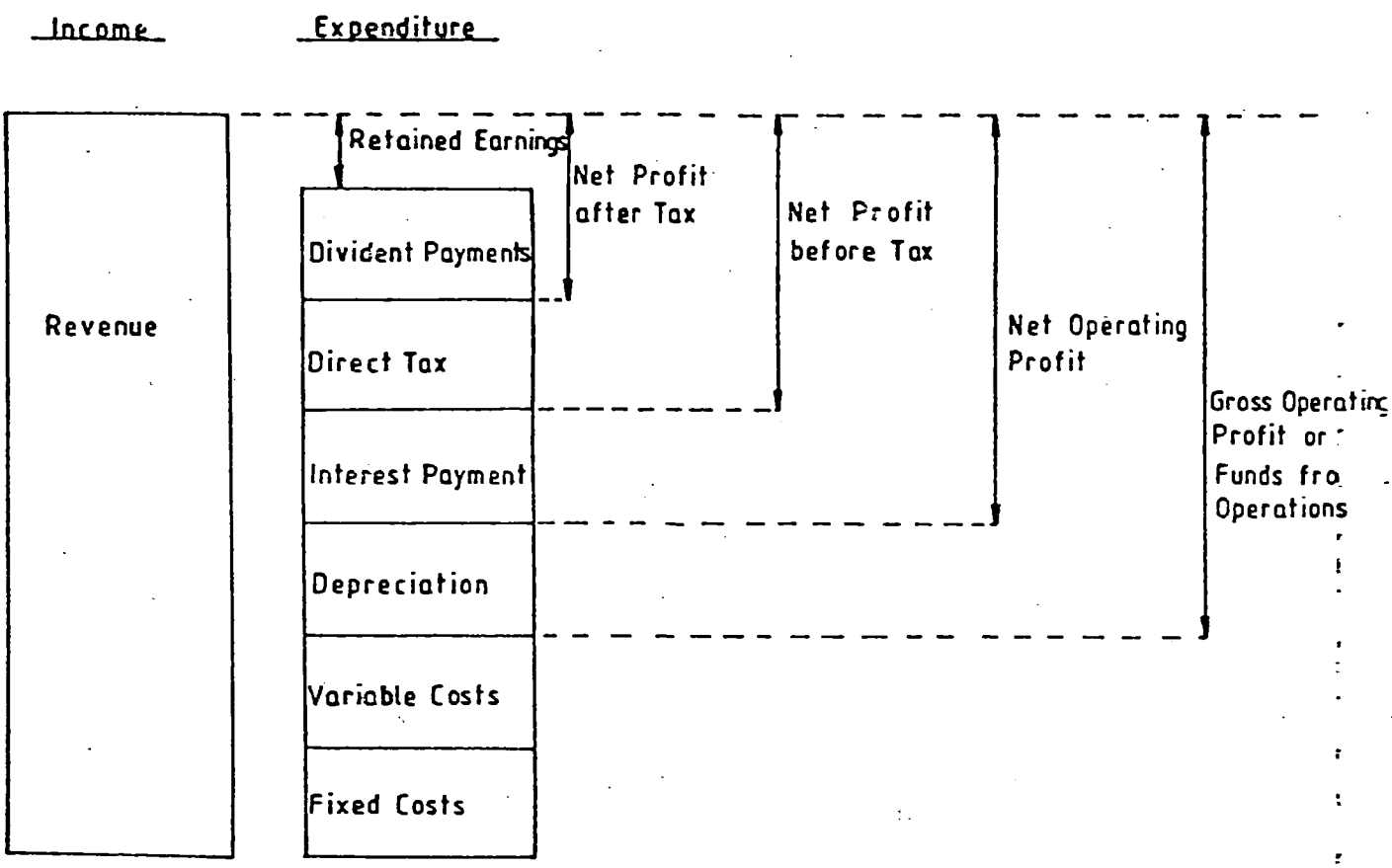
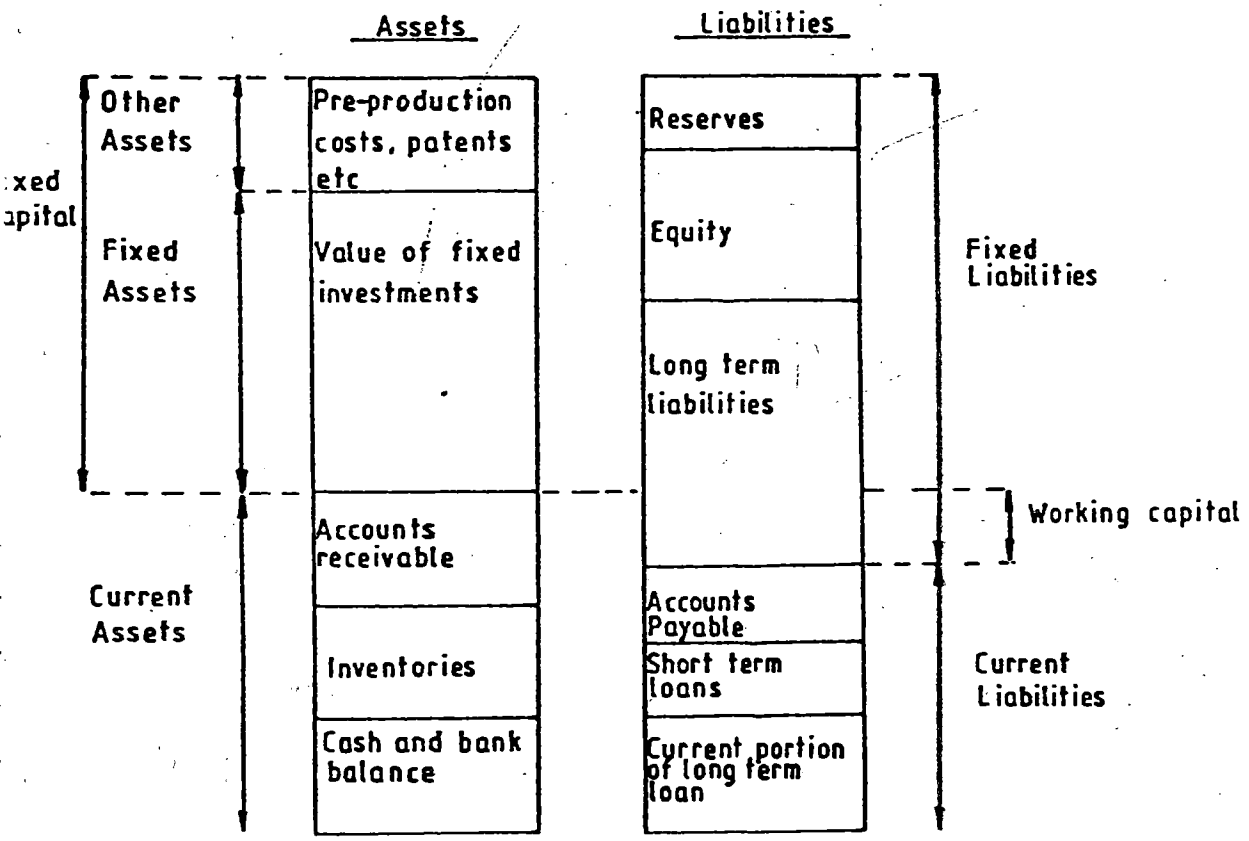


FIGURE 6 THE BALANCE SHEET



3.2. The balance Sheet.

The name 'balance sheet' does already reflect the principle that its two sides must balance. On the one side the assets of a project are presented, while on the other side the liabilities and owners equity appear. The balance sheet equation, therefore, reads as follows:

Assets = Liabilities + Owners Equity

Assets are the properties or the claims to other persons' properties owned by an enterprise or project. Liabilities are claims of creditors to the assets of an enterprise or project. In other words: assets represent items of value to the project or they are items the project owns, while liabilities are outstanding debts or items the project owes. Both assets and liabilities can be distinguished in a fixed and a current portion.

Fixed assets are items of relatively long life, in any case longer than one year, and are used for the production of goods or the rendering of services. In a project these items are normally bought before the project starts (year 0), although it may well be that a part is added later. Fixed assets are, unlike variable inputs (raw materials, energy), not used up in the production process. Examples include buildings, equipment, machines and land. These assets may loose their value over time due to their use in the production process. Depreciation makes allowance for this loss of worth. In the appraisal stage of a project one has to calculate the value of the (total) fixed assets. Usually a contingency (say 5 - 10%) is included in this computation to take unforeseen expenses into account or to allow for adverse conditions that will add to the costs of obtaining the fixed assets. These contingencies are added to the total costs of the assets before depreciation occurs.

Current assets include items that present an immediate value to the project or represent payment within one year of the date of the balance sheet. Examples of the former are the cash and bank balance, while expected payments by debtors within one year and the selling of inventories exemplify the latter. In some projects and enterprises other assets may appear as an item on the balance sheet. This category can include investments made elsewhere by the project; deferred expenses, such as start-up expenses (pre-investment studies, for instance), to be charged over several accounting periods; and 'intangible assets' like patents and trade-marks.

Fixed liabilities consist of medium and long term debts. These debts can either be loans to be repaid after one year or credits that become payable after one year from the date of the balance sheet. Like with assets, the 'fixed' element of liabilities reflects the fact that a project or enterprise is not supposed to have financial transactions concerning these items within one year. Current liabilities on the other hand are items that have to be paid within one year of the date of the balance sheet. These items include the 'current portion' of a long term loan,

short term loans (repayment within one year) and taxes to be paid within a year.

Owners' Equity is the last item of the balance sheet and reflects the claims by the owners of the project against the assets. It is a residual as it consists of what is left after all liabilities have been deducted from the total assets (Price Gittinger, 1982). Owners' Equity is generally composed of two elements: share capital, paid in by the owners of a project, and retained earnings ('reserves'), which represent the earnings of the project in the course of its operations.

The balance sheet is a snapshot of the financial situation of an enterprise or project at a particular point in time, usually at the end of a financial year, and shows all the assets, liabilities and equity of the enterprise or project at that particular moment. It is implicit that items appearing on a balance sheet refer to 'stock concepts', rather than 'flow concepts'; the latter ones do appear in the income statement or the cash flow statement.

An example of a balance sheet in tabular form is presented in table 3, while figure 6 presents the information graphically. The term working capital is by convention defined as the difference between current assets and current liabilities.

Table 3. Layout of a balance sheet (in the British usage).

Assets	Liabilities
1. Fixed assets (original value minus accumulated depreciation)	3. Long term liabilities
2. Current assets (cash and bank balance; inventories; accounts receivable)	4. Current liabilities (loan payments within one year; accounts payable)
	Equity
	5. Equity (share capital)
	6. Reserves (accumulated retained earnings)

By definition should the total assets (1+2) be equal to the total liabilities (3+4) plus owners equity (5+6).

3.3. The Cash Flow Statement.

The cash flow statement is in many ways comparable to the income statement, as it deals with flow rather than stock concepts and reports about transactions in a (financial) year. But unlike the income statement, which is based on 'normal' or 'business' accounting, the cash flow statement is based on cash flow accounting. Cash flow accounting is concerned with the systematic reporting of flows of money in and out of the project at constant prices over the life of the project. The important principle is that these flows are recorded at the time they actually occur. This means, for instance, that depreciation is an item which will not appear in a cash flow statement. Payments for fixed assets

appear at the actual moment of purchase or replacement. For financial analysis of projects market prices are used, while for economic and social project appraisal accounting prices are applied (see section 8).

The net cash flow (or net benefits) represents the amount of money that remains after all outflows are subtracted from all inflows. The incremental net cash flow refers to the increase in net benefits due to the project. In other words: it subtracts the net benefits without the project from the net benefits with the project. Both the net cash flow and the incremental net cash flow can be negative, especially in the early years of a project. The incremental net cash flow forms the basis for the calculation of some important measures of project worth, like the Net Present Value and the Internal Rate of Return (see section 5).

Cash inflows are streams of money that accrue to the project and originate from sales, borrowing or equity capital. Cash outflows, on the other hand, comprise all payments of a project to the 'outside world' within the lifetime of a project. Common categories are: investment costs, operating costs, interest charges, repayments, taxes and dividends. Both in- and outflows are recorded at the time (in the financial year) they actually occur.

The cash flow statement summarises all cash inflows and outflows over the financial years in the lifetime of a project. The statement can be subdivided into two parts:

(a) the cash flow from financial operations, which includes equity, borrowing, repayment, interest payment and dividend payment, and
(b) the cash flow from non-financial operations, comprising revenues, investment costs, operating costs and taxation.

Discounting (see section 4) the cash flow from non-financial operations (b) forms the basis for an indication of project worth based on the activity itself (and regardless of the way it is financed) and therefore assesses its profitability. The total cash flow (= a + b) can give an idea of the projects worth when financial obligations are included, but is primarily used in liquidity analysis (see below).

An example of a cash flow statement is given in table 4. Figure 7 presents the statement in a schematical way.

Table 4. Sample Cash Flow Statement.

Item	year 0	1	2	3	4	5 etc.
1. Revenue						
2. Investment Costs						
3. Operating Costs						
4. Taxation						
5. Cash flow from non-financial operations (=1-2-3-4)						
6. Equity						
7. Dividends						
8. Loans						
9. Repayment						
10. Interest Charges						
11. Cash flow from financial operations (=6-7+8-9-10)						
12. Total Cash Flow (=5+11)						

Liquidity analysis is concerned with the inspection of the total cash flow. At no point in time during the 'life' of a project should the total cash flow be negative. If it occurs, then a liquidity crisis will be imminent. If at the moment of appraisal the likelihood of a future occurrence of a liquidity crisis is detected, then arrangements will have to be made to prevent it from happening.

Profitability analysis is an inspection of the cash flow from non-financial operations to assess whether the project is profitable or not. Widely used measures of project worth, like the Net Present Value and the Internal Rate of Return, are based on the these cash flow figures. The cash flow from non-financial operations is therefore one of the most important items needed for a proper project appraisal. The way the project is financed and all the consequences (loan repayment, interest charges, dividend payments etc.) can be ignored. This is because they are implicitly taken into account in the discount rate used (Lumby, 1988, p. 124). In fact for the NPV analysis it does not matter whether one includes financing or not. For simplicity purposes one can therefore better leave it out.

The cash flow statement for the shopping complex project is presented in table 5. The cash flow is presented from the viewpoint of the City Council of the small town, which implies that the main outflow of money will be in year 0, the year in which the council procures the (then just) finished complex. As the owner of the complex, the council has to pay service charges for electricity, water etc. and to pay for other running costs (maintenance and repairs, for instance). This is estimated to be Z$ 12000 per year for the complex. The rent for each shop was set at Z$ 7500 per year, which makes Z$ 37500 for the entire shopping center. This amount presents the annual cash inflow for the council. It is assumed that the council pays the initial investment out of its own reserves. This implies that there is

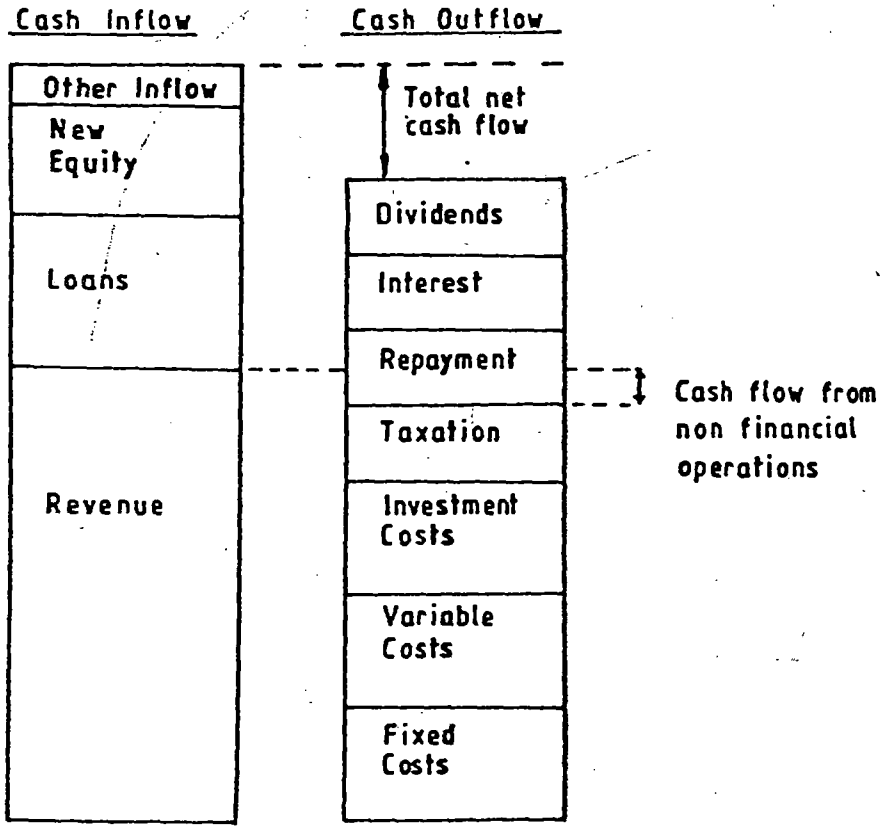
no need for a loan and subsequent repayment and interest payments. The total cash flow presented in table 5 is therefore at the same time the cash flow from non-financial operations.

Table 5. Cash flow statement for the shopping complex project.

item	year 0	1	2	 25
INFLOW:				
Rent		37500	37500	37500
OUTFLOWS:				
Purchase of complex	-224400			
Running costs		-12000	-12000	-12000
NET CASH FLOW	-224400	25500	25500	25500

The table shows that in year 0 there will be a flow of money out of the project, hence the negative figure in the line of the net cash flow. In subsequent years the council will experience a net inflow of funds as the income from rent will be much larger than the expenditure on running costs.

Figure 7 CASH FLOW STATEMENT



4. TIME VALUE OF MONEY.

Over time money tends to loose its value. This is common knowledge and is based on the principle that people have a time preference for immediate above deferred use of money. For instance, people tend to prefer consumption at this moment above consumption at some point in the future. If for some reason someone has to defer the use of his money he will like to see a compensation for this 'usage forgone'. If one puts money in the bank than this compensation is expressed in the interest rate.

The actual interest rate of a bank not only depends on the time preference for money, but also on the expected rate of inflation, although inflation is usually not fully accounted for. Interest rates charged by banks will in addition include fees for administration, and for a risk factor (the likelihood that borrowed money will not be returned).

Another reason why a higher value is attached to money at the present moment than at some time in the future is that it can be invested, resulting in a surplus in the years to come. The investment can take many forms, one of which is to put it in a bank. Therefore, if one will receive some form of income in, say, three years instead of now, one will generally want some kind of remuneration for the "investment opportunity foregone".

The techniques of compounding and discounting make use of the notion that money has got a time value. In the application of the techniques usually two conventions are adhered to:

(1) money is borrowed and returned on the last day of an accounting period (year), and
(2) interest is stated on an annual basis.

Standard compounding and discounting tables exist that help in the calculation of the present or future worth of an amount of money. Annex 2 presents the tables for discount (interest) rates from 5 up to 25%.

4.1. Compounding.

Compounding is concerned with the calculation of the future worth of a present amount of money. Over the years an initial amount of money will grow as it bears interest, but interest will also be accounted over the interest of previous years (compound interest). For example, an amount of $ 10,000 will grow at a 10% interest rate. After one year the worth will be: $ 10,000 + (10% x $ 10,000) = $ 10,000 + $ 1,000 = $ 11,000. The next year it will increase by another 10%, that is: $ 11,000 + (0.10 x $ 10,000) = $ 12,100. In another notation: the worth after one year was a factor 1.1 of the initial amount ($ 10,000); after two years the factor was 1.21. This process continues over the years. An initial amount grows increasingly and the same applies to the multiplication factor used to find the future worth. The

multiplication factor is better known as the Compounding Factor (CF).

In general, the formula for the compounding factor reads:

$$CF = (1 + i)^n$$

where CF = Compounding Factor
i = interest rate
n = compounding period in years

If instead of an initial amount an equal stream of money is deposited each year at a certain interest rate, one can use the compounding factor for 1 per annum to calculate the value at the end of a project period. For example, if $ 10,000 is deposited for three consecutive years (at the end of a year!) at a 10% interest rate its value at the end of the period will be $ 33,100. This can be found by compounding the separate amounts and adding them: the $ 10,000 of year 1 will increase to $ 11,000 after year 2 and $ 12,100 after year three; the $ 10,000 deposited in year two will be worth $ 11,000 at the end of year three; and the $ 10,000 of year three is only deposited at that time and does not bear interest. This, however, is a rather tedious process and a shortcut is provided by the compounding factor for 1 per annum. This factor for three years at 10% interest is 3.310. A multiplication of the annual amount ($ 10,000) by this factor also provides $ 33,100.

The opposite of the compounding factor for 1 per annum is called the Sinking Fund Factor. The Sinking Fund Factor can be used to find the annual deposit required to reach a certain value of money by a given year at a stated rate of interest. If someone wants to have $ 33,100 after 3 years at a 10% interest rate he has to deposit $ 33,100 x 0.302 (Sinking Fund Factor for 3 years, 10% interest) = $ 10,000 each year. The compounding factor, the compounding factor for 1 per annum and the Sinking Fund Factor can all be found in standard tables (see annex 2).

4.2. Discounting.

Discounting is in fact the opposite of compounding. The interest rate applied for discounting is called the discount rate and can be compared with a negative rate of interest. Discounting enables us to find the present worth of an amount of money at a future point in time. It is a common procedure in project appraisal to reduce the future worth of costs and benefits as a reflection of the lower value that people tend to attach to them the further away in time they appear. To calculate the present worth of future costs and benefits a Discount Factor (DF) is used.

Suppose someone wants to know what $ 11,000 in one year time will be worth today at a 10% discount rate. From the previous examples it is obvious that the answer will be $ 10,000 and that it can be obtained by dividing $ 11,000 by 1.10 (= 1 + interest rate). A different notation is: $ 11,000 x (1/1.10). The last part (the

fraction) represents the discount factor and in this case is equal to 0.909. The same figure appears in a standard discount table after year 1 at a 10% interest rate.

The general formula for the Discount Factor is:

$$DF = \frac{1}{(1+i)^n}$$

Note that DF can also be expressed as 1/CF.

In projects and enterprises equal annual streams of costs and benefits are not uncommon. The shopping complex project is a case in point. The discounting of these annual streams (or annuities) can be done by a shortcut method: the application of the Present Worth of an Annuity Factor (PWAF). This factor indicates the present worth of a constant future income stream of 1 unit a year. Multiplying by the actual annual income stream provides the present worth of this stream. The Present Worth of an Annuity Factor is in fact the running cumulative of the Discount Factors over the years. For example, the annual income stream of the shopping center was $ 25500. To find the present worth of this stream one can multiply it by the PWAF for 25 years at the chosen discount rate. If we choose a 10% discount rate the PWAF will be 9.077 and the present value of the income stream will be 25500 x 9.077 = Z$ 231463.50.

While applying the discounting technique this paper will use the (World Bank) convention that discounting starts in year 1, after the bulk of the investment will have been made in year 0. This is more convenient than the alternative (initial investment in year 1, discounting starts in year 2), as project years will be the same as the years stated in the discount tables.

The reciprocal of the Present Worth of an Annuity Factor is called the Capital Recovery Factor. The Capital Recovery Factor can be applied to find the level of constant annual payments in order to repay a loan over a given period of time at a stated rate of interest. In project planning it can be used to design a debt service schedule in such a way that the debt service (repayment of principle and interest payment) can be spread equally over the life of a loan. For example, if a loan of $ 10,000 bearing 10% interest has to be repaid in 4 years time, this can be done in several ways. One way would be the payment of 10% interest over 4 years ($ 1,000 annually) and repayment of the principle ($10,000) in year 4. Another schedule could be payment of 10% interest on $ 10,000 in year 1 and 2 only, repayment of half of the loan at the end of year 2 , 10% interest over the remaining $ 5,000 ($ 500 annually) in years 3 & 4 and the final repayment of the remaining part of the principal at the end of year 4. Alternatively, however, one can spread the expenses through use of the Capital Recovery Factor. This Factor for 4 years at 10% interest is 0.315 (see table in annex 2). Consequently, in this case the annual payment should be 0.315 x $ 10,000 = $ 3,150.

4.3. Choosing the discount rate.

The choice of the discount rate depends on the type of project appraisal and the way capital will be attracted for the project. However, the principle is the same: one has to look for that rate which is the normal reward for the use capital.

As stated before, in financial appraisal one analyses a project from the private, individual or project point of view. This implies that one has to find the 'normal' reward for private capital if one wants to discover the appropriate discount rate. That rate will often be the one at which the project is able to borrow money, i.e. the market rate of interest, which -of course- has to be corrected for inflation. When own funds are being used it is the (real) rate which banks would give on the deposit of such funds (Irvin, 1978). In case one is raising funds through share capital the discount rate will be determined by the return needed to attract that equity capital (Price Gittinger, 1982). One can also see the discount rate as that rate which a project or enterprise wants to obtain on its investment (the target rate). In the words of Little and Mirrlees (1974: 12): "[the discount rate] is the rate of return which, given the financial conditions for obtaining cash and the investment opportunities likely to be open to the firm in future years, it deems prudent to aim to earn on its new investments".

In economic appraisal the determination of the discount rate or economic accounting rate of interest (EARI) is more complicated. Several (theoretical) methods exist, but it is now generally preferred to look at the 'opportunity costs of capital'. This is a rather theoretical conception and can be defined as 'the rate of return of the marginal project in society when all investable resources are absorbed'. Although useful as a theoretical concept, the opportunity cost of capital is not easy to calculate and to apply in practice. No one will exactly know what the opportunity cost of capital in a society is. Fortunately for the project analysts he or she can normally rely on information provided by a central planning agency or the Ministry of Economic Affairs. In most countries these agencies provide a reliable estimation of the opportunity costs of capital and hence the discount rate to be applied. It is strongly advised to use this rate in economic project appraisal. The use of a single and widely accepted discount rate is the only way to compare different kinds of (social/regional) projects, even if the appraisal is carried out by various agencies.

Alternatively, in economic appraisal one can estimate the discount rate on the basis of a representative sample of public and private investment projects, which may point at the IRR (see 5.8.) of the marginal project. This IRR can then be taken as the discount rate prevalent in society.

The distinction above also implies that there may be a different discount rate in financial and economic appraisal. Normally the one in financial appraisal will be somewhat higher. This is also

theoretical justified as it reflects the private, shorter time horizon as opposed to the longer, societal one (seen from the consumption point of view) or the acceptance of lower yielding projects by the public sector as opposed to more profitable ones in the private sector (investment point of view).

The discount rate is generally assumed to be somewhere between 8 and 15 percent in most developing countries (Price Gittinger, 1982). Nevertheless, some people cast doubt on these figures and state that they are much too high. Riezebos (1983) imagines that a correct discount rate will be between 4 and 8 percent.

In social appraisal a Social Accounting Rate of Interest (SARI) is introduced, which again may be higher or lower than the opportunity costs of capital, depending on the distributional impact of the income flows (see section 8).

The choice of a correct discount rate is essential in project appraisal. To a large extent it determines whether to accept or reject a project or which project to choose among alternatives. With respect to this Little and Mirrlees (1974:50-51) note : "It has increasingly been realised that the discount rate plays quite a powerful role in deciding which kind of investment looks best. For instance, it is well known that the decision whether to have nuclear or conventional energy is sensitive to the rate of discount. Another example is electrification versus dieselisation of railways. In each case, the former method uses more capital initially, but saves costs later, and so requires a relatively low rate of discount of the future to look better than the latter".

5. MEASURING PROJECT WORTH.

The financial, economic or social appraisal of projects usually involves the expression of its worth in one summarising measure. A range of measures exists and the choice of the proper one depends on the complexity of the project, its lifetime, the data available, and the accuracy required. Below the most common measures are presented. The first five measures (5.1. up to 5.5.) can only be applied in rather simple projects; projects with a lifetime of one year, or projects with annual equal streams of costs and benefits. These measures are generally based on the income statement and do not use the technique of discounting. The other three measures (5.6. up to 5.8.) are widely used in Cost-Benefit Analysis and involve discounting of streams of costs and benefits. Cost-Effectiveness Analysis is somewhat different from the measures presented here, as it excludes the valuation of benefits, and is treated in section 7.

5.1. Net Profit.

Net profit is a measure widely used in business circles to express the financial degree of success of an enterprise over an accounting period. In principle it can be applied in a similar way in project appraisal, although in the latter case it is based on an ex ante assessment of the project's performance.

Net Profit can be defined as:

Net Profit: = Revenues - [(fixed + variable) operating costs + depreciation + interest]

It can also be found as one of the last items of the income statement (no. 7 in table 1, although also no. 5, Net Operating Profit may be used). This indicator tells the analyst whether a project is covering its costs and by how much, or in other words: whether the project makes a profit in a year of operation.

The net profit of the one year of operation of the council fields project was calculated as Z$ 32262.00. This figure is a positive amount and therefore the project certainly is acceptable. Although it is clear that it is also an impressive amount, it does not tell so by itself. To find the (relative) level of profitability one has to relate the net profit to other items, like the investments made, as is done in the simple rate of return.

5.2. Simple Rate of Return.

The simple rate of return can be defined as the (annual) net (operating) profit divided by the total investments multiplied by 100%. The measure tells how much profit is made for the money invested. One uses the net operating profit as one is interested

in the rate of return of the activity itself, regardless of the consequences in the way of financing.

Investment in the formula can be replaced by owners equity to find the return to equity. This measure is like the previous one based on 'normal accounting' rather than cash flow accounting. Its use should be restricted to small and rather straightforward projects.

The rate of return of the council fields project can be calculated as follows:

Simple Rate of Return = $\frac{\text{Z\$ 32262 (net profit)}}{\text{Z\$ 2000 (investments)}} \times 100\% = 1613\%$

Clearly this is an impressive result, which can be attributed to the fact that the investments were minimal. This again was due to the fact that land (a major capital item) was obtained free of charge and that the project would be carried out on a one year trial basis only, requiring minimal investments in farming equipment. Nevertheless, one would find very few projects with similar rates of return and a project analyst would definitely advise to carry out this project on financial grounds.

5.3. Break-even point.

The break-even point can be defined as that point in time when, or that volume of production at which the project benefits equal the project costs. This means that in fact there are two different ways to calculate the break-even point, one in terms of production volume, another in terms of time. In formula form it can be presented as follows:

Break-even point = $\frac{\text{(annual) fixed costs}}{\text{(revenue per unit or time period - variable costs per unit or time period).}}$

The fixed costs include depreciation and overheads.

The break-even point points at that volume of production or moment in time at which no more losses are incurred. It can also be used to inform the investor about the rate of capacity utilization at which production must take place in order not to loose money.

The principle can be exemplified by the shopping complex project. The annual fixed costs in this project are made up of depreciation and the (fixed) running costs (Z$ 12000 annually). If the project lasts for 25 years and straight-line depreciation is applied, then the annual depreciation charge will be Z$ 224400/25 = Z$ 8976. Consequently, the total annual fixed costs will be Z$ 20976, while the annual revenues were estimated at Z$ 37500, which would be Z$ 3125 per month. The break-even point in time with full capacity utilisation (all shops rented full time) will be 20976/3125 = 6.7. This means that in a year of operation it will take close to 7 months before revenues in the project have equaled the annual costs.

5.4. Pay-back period.

The pay-back period is in some way similar to the break-even point, in as far as it points at a moment in time at which a project becomes a 'safe' venture. But where the break-even point refers to the (annual) production volume or time needed to repay the annual fixed costs, the pay-back period looks at the overall project time needed to earn money to repay the original investments made. The pay-back period can be defined as:

$$\text{Pay-back period} = \frac{\text{total investment}}{\text{(annual) net operating profit}}$$

In total investment one usually includes the pre-production costs and the initial working capital requirements.

The pay-back period tells the investor how quickly he/she can recover the initial investment or capital. The project that recovers its costs in the shortest period will be chosen (cost recovery criterion). Although it does not take the time value of money into account, it is widely used in business circles, certainly when there is a substantial risk factor in the project or in the economy as a whole. In those cases one wants to recover the initial investments as soon as possible.

The shopping complex project can serve again as an example. The total investments for the council were Z$ 224400, while the annual profit would be Z$ 37500 (income from rent) - Z$ 12000 (running costs) = Z$ 15500. Consequently the pay-back period will be 224400/15500 = 14.48. In other words: it will take nearly fourteen and a half years before the initial investments are earned back by the operation of the project. Note that at this stage no discounting has taken place and that consequently costs and benefits at different points in time are valued equally.

5.5. Earnings per labour hour.

The earnings per labour hour is an appraisal criteria that can be applied in different circumstances than the other measures mentioned in this chapter. It basically refers to small-scale, localised, and household-based activities of a part-time and/or seasonal character as opposed to full-time, more business type projects. The projects referred to here "are usually small, require only small capital outlays, and are undertaken with the aim to deploy household labour resources so as to generate a larger [family] income" (Helmsing, 1989:43).

The measure can be defined as:

$$\text{Earnings per labour hour} = \frac{\text{revenue per unit - non labour costs per unit}}{\text{hours of labour per unit.}}$$

This measure tells the investor (owner-operator) his reward for an hour of work on the basis of which he can decide to start the activity or find a more rewarding one. As said before the indicator is only relevant for very small projects (self-employment, family business) as in other projects labour will be

paid at a stated (normal) wage rate.

A very small project, a back-yard rabbit production project, may serve as an example. Five rabbits, one male and four females, are bought for breeding purposes. It is assumed that each female gives birth to 10 young rabbits, twice a year, and that the young rabbits after some months will be sold at Z$ 5.00 each. This implies that the revenue of the rabbit unit will be 4 x 10 x 2 x Z$ 5.00 = Z$ 400 a year. The investment costs (cage, rabbits etc.) will be Z$ 100, while the life of the assets is estimated at 10 years. Annual (straight-line) depreciation is therefore Z$ 10.00. Other annual (variable) costs refer to rabbit feed, tick and mite dip etc. and amount to Z$ 50.00 a year. The owner-operator will on average work 4 hours a week on his rabbit unit, which makes an annual total of 52 x 4 = 208 hours.
Earnings per labour hour can then be calculated as:

$$\frac{\text{Z\$ 400 (revenue) - Z\$ 60 (non-labour costs)}}{\text{208 (hours of work}}$$

$$= \text{Z\$ } 340/208 = \text{Z\$ } 1.63 \text{ per hour.}$$

The rabbit breeder may now compare these earnings to other alternatives of deploying his labour.

5.6. Net Present Value (NPV).

The Net Present Value (NPV), sometimes called the Net Present Worth (NPW) is one of the most widely used measures of project worth. It is the difference between discounted streams of benefits and costs, or the discounted net cash flow. Its calculation is based on the cash flow from non-financial operations (see section 3.3.).

The measure tells what the present worth of a project is, in absolute terms. The implication is that larger projects are likely to have a higher NPV than smaller ones, although the smaller ones might be more profitable, as expressed in the rate of return to the invested capital. If investment capital is not a limiting factor, however, but rather management capacity so that only one (or a few) project(s) can be selected, than the NPV might be a legitimate choice in ranking projects.

As a rule one should accept all projects that show a positive NPV. This rule applies as long as the discount rate has been set correctly. In applying the NPV the discount rate should therefore always be mentioned!

We turn once again to the shopping complex to illustrate the principle of the calculation of the NPV. The net cash flow showed a negative amount of Z$ 224400.00 in year 0, while in the subsequent 25 years there would be a positive figure of Z$ 25.500 annually. If the discount rate is set at 10% -as was done by the advisers to the city council- then the NPV could be discovered by applying the Present Worth of an Annuity Factor (PWAF) to the net cash flow stream over the 25 years. Year 0 will, by

definition, not be discounted as it already expresses the present worth. Table 6 provides the calculation.

Table 6. NPV calculation for the shopping complex project.

Year	undiscounted amount	DF/PWAF	discounted amount
0	-Z$ 224400.00	1	-Z$ 224400.00
1-25	Z$ 25500.00	9.077	Z$ 231463.50
		NPV =	Z$ 7063.50

As can be seen from the table the NPV of this project is positive. It is therefore an acceptable venture for the council.

5.7. Benefit-Cost Ratio (BCR).

The Benefit-Cost Ratio is simply the ratio between the discounted streams of benefits and costs. A distinction can be made between the gross and the net B-C ratio. The gross B-C ratio is based on calculations in which the variable costs (operating costs) are included in the total costs, while in the net B-C ratio the variable costs are deducted from the benefits to find the stream of (net) benefits. Like with the NPV, the discount rate needs to be mentioned. Projects with a B-C Ratio above 1 indicate a stream of benefits larger than the stream of costs and are thus acceptable. The higher the B-C Ratio, the higher the discounted benefits relative to the discounted costs and the more attractive the project becomes. Although it is a very valuable measure of project worth, it does not tell the investor the return to capital directly, but only that it will be above the discount rate the moment the ratio is above 1.

The variable costs in the shopping complex project were Z$ 12000 a year, while the gross benefits were Z$ 37500 annually. Combining this information with the investment costs (Z$ 224400) is sufficient to calculate the gross and net BCR. For the gross BCR we have to find the discounted total benefits and divide it by the discounted total costs (including variable costs). Here this will be:

year	DF/PWAF	discounted benefits	discounted costs
0	1	0	224400
1-25	9.077	340387.50	108924
		340387.50	333324

Gross BCR = 340387.50/333324 = 1.02

A similar calculation can be done for the net BCR:

year	DF/PWAF	discounted benefits	discounted costs
0	1	0	224400
1-25	9.077	231463.50	0
		231463.50	224400

Net BCR = 231463.50/224400 = 1.03

The net and the gross BCR may differ slightly, as in the example above, but will both either point at an acceptable project (i.e. ratio > 1) or an unacceptable one (ratio < 1).

A variant to the B-C Ratio is the Net Benefit/Investment Ratio. This ratio can be approached through use of the following definition. NBI-ratio =

$$\frac{\text{discounted net incremental benefits in later (positive) years}}{\text{discounted net benefit stream in early (negative) years}}$$

This approach assumes an initial investment to take place in early years of a project, after which the net cash flow will become positive. Re-investments in later years may cause the cash flow to be negative, but as long as it is a single negative figure, it is acceptable to include it in the net incremental benefit stream.

5.8. Internal Rate of Return (IRR).

The Internal Rate of Return is the discount rate at which the (discounted) streams of costs and benefits are equal. In other words: the discount rate at which the NPV is 0 and the B-C ratio exactly 1. The IRR indicates the earning rate of money invested in a project and therefore is generally the preferred measure for investors. It also tells the maximum interest rate a project will be able to pay for the resources used, or -in other words- the rate of return to capital internal to the project. All projects that show an IRR above the market rate of interest are acceptable in financial analysis, in economic analysis a comparison needs to be made with the opportunity costs of capital (or EARI, also see 4.3.), and in social analysis the Social Accounting Rate of Interest will serve as the yardstick. Internationally it is the most common measure of project worth and preferred by many agencies. The IRR is based on the cash flow from non-financial operations (see table 4), just like the NPV and the BCR.

Finding the IRR is not always straightforward and usually involves a process of trial and error until two rates are found that give an NPV near 0: one slightly below and one somewhat above 0. Then the following formula can be applied:

$$IRR = D1 + (D2-D1)[NPV1/(NPV1-NPV2)]$$

in which

D1 = the lower discount rate (causing a positive NPV!)
D2 = the higher discount rate (causing a negative NPV!)
NPV1= Net present value at rate D1
NPV2= Net Present Value at rate D2.

The following example applies this formula for the IRR. Suppose a project requires an initial investment in year 0 (Z$ 100) and a smaller amount in year 1 (Z$ 50). The operating costs will be Z$ 40 in year 1 and Z$ 50 in the rest of the life of the project (years 2 - 5) and the incremental net benefits have been estimated at Z$ 50 in year 1 and Z$ 100 in years 2 - 5. If one calculates the NPV at a 10% discount rate, then a value of Z$

7.69 appears. As this is a positive NPV, the other NPV to be applied in the formula should be negative. Consequently, the concomitant discount rate should be higher than 10%. If we try 14%, an NPV of - Z$ 4.93 results, so that we can apply the formula above:

IRR = 10 + (14-10)[7.69/(7.69--4.93)]
= 10 + 4 x (7.69/12.62)
= 12.437% or rounded off: 12.4%

Note that rounding off of an IRR will always have to be done downwards, as the formula above will (slightly) overstate the actual value!

Table 7 summarises the information of this example in tabular form.

Table 7. Sample calculation of an IRR.

Year	Incremental Costs	Benefits	Net Benefits	DF 10%	Present Worth	DF 14%	Present Worth
0	100	0	-100	1	-100	1	-100
1	90	50	- 40	0.909	-36.36	0.817	-32.68
2	50	100	50	0.826	41.3	0.769	38.45
3	50	100	50	0.751	37.55	0.675	33.75
4	50	100	50	0.683	34.15	0.592	29.6
5	50	100	50	0.621	31.05	0.519	25.95
				NPV =	7.69	NPV =	-4.93

IRR = 10 + (14-10)[(7.69/7.69+4.93)] = 12.4%

If there is a constant stream of benefits and only (investment) costs in the first year(s), the IRR can be found using the Present Worth of an Annuity Factor. This involves the following steps: first the investment costs are divided by the annual benefits to find the required PWAF; second one looks at the discount tables under Present Worth of an Annuity Factor and at the number of years that represent the lifetime of the project until one finds a factor that is very close to the PWAF calculated in the first step. The IRR will be close to the discount rate stated in that table.

This can be shown by the shopping complex project, where the investment costs were Z$ 224400 and the annual benefits Z$ 25500. Consequently we are looking for a PWAF of 224400/25500 = 8.8 at 25 years. The PWAF at 10% is 9.077, while at 11% it is 8.422. The IRR of this project will therefore be between 10 and 11 percent (in fact it is 10.4%). For most appraisals a rather rough indication like this will suffice. If one likes a more refined answer one can apply the formula above or alternatively use a computer programme.

The term 'Internal Rate of Return' (IRR) is used to indicate the general methodology and is a technical term. In project appraisal the names Financial Rate of Return (FRR), Economic Rate of Return (ERR) and Social Rate of Return (SRR) are commonly used, depending on the type of analysis.

Although a powerful indicator, the IRR has some disadvantages. The first is that in exceptional cases in a project two IRR's may exist. This may for instance be the case when the net cash flow stream in earlier years is negative, then positive and later on again negative. The second disadvantage is that the measure can not be used in the selection of mutually exclusive projects. Both issues will be covered in more detail in section 6.

5.9. A comparison of indicators.

It is not always clear which measure of project worth to choose. Most handbooks on project appraisal prefer the IRR, the B/C Ratio, the NPV or a combination of the three. For some projects these methods might even be too advanced or time consuming. In those cases 'simpler' measures might be more appropriate. A key-word overview of the measures discussed is presented in figure 8. This figure intends to facilitate the choice of method and to warn against drawbacks involved.

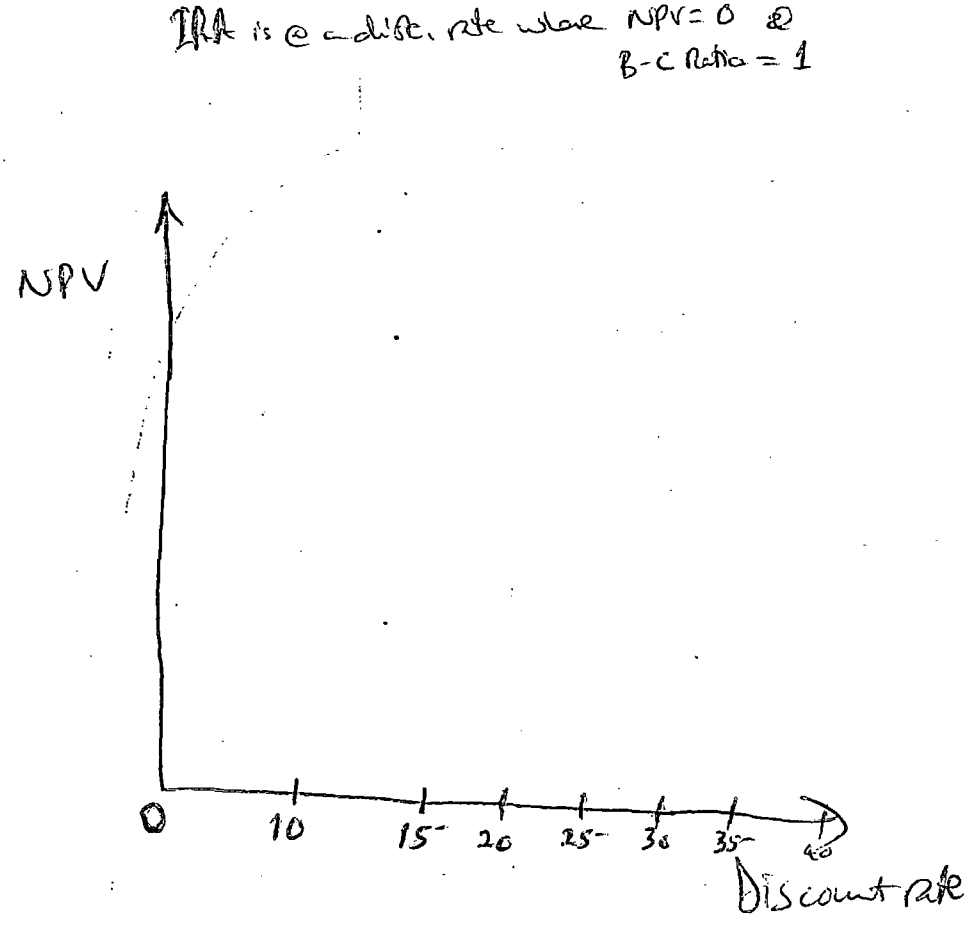


Figure A. Keyword comparison of indicators of project worth

Issues / Indicators	Calculation based on:	Indicator tells:
1. Net Profit	Income Statement	the amount of profit in an (average) year of operation
2. Simple Rate of Return	Income Statement	the rate of (annual) profit to investment
3. Break-even point	Income Statement	volume of production or production time in a year of operations at which no more losses occur
4. Payback Period	Income Statement	time required to repay initial investment out of profit
5. Earnings per Labour hour	Income Statement	net earnings for an hour of work
6. Net Present Value (NPV)	Cash Flow from non-financial operations	the worth of a project at present in absolute (money) terms
7. Benefit-Cost Ratio (BCR)	Cash Flow from non-financial operations	the ratio between the present value of the benefits and the present value of the costs of a project
8. Internal Rate of Return (IRR)	Cash Flow from non-financial operations	average (annual) return to capital invested

Project is acceptable when:	Remarks/Drawbacks
Net Profit is positive and higher than a desired level	1. rate of profitability unknown 2. no unambiguous yardstick for decisions about acceptability 3. only to be applied as an initial indicator in simple projects
Simple Rate of Return is higher than a desired level	1. no unambiguous yardstick for decisions about acceptability 2. only to be applied as an initial indicator in simple projects
Break-even point falls before or at a desired moment	1. no unambiguous yardstick for decisions about acceptability
Pay-back Period is shorter than a desired period	1. no unambiguous yardstick for decisions about acceptability
Earnings are higher than a desired wage rate	1. no unambiguous yardstick for decisions about acceptability 2. only to be applied in simple and small scale projects
NPV > 0	1. does not tell the rate of profitability of a project 2. can not be used in ranking of projects
BCR > 1	1. does not tell the rate of profitability of a project 2. differences between gross and net BCR should be kept in mind
IRR > discount rate	1. can not be used in the selection of mutually exclusive projects 2. in exceptional cases a project may have two IRR's

6. SOME EXTENSIONS TO APPRAISAL CRITERIA.

6.1. The NPV-curve.

A very useful graph that gives a good overview of a projects worth is the NPV-curve. The NPV-curve shows information about NPV's of a project at different discount rates, including the IRR of a project (NPV=0). On the Y-axis the NPV value is stated, while the X-axis presents the discount rate. As stated before, a project is acceptable as long as the NPV is positive, provided that the discount rate reflects the costs of capital. This is anywhere in the figure where the curve is above the X-axis. The point where the curve exactly cuts the X-axis tells the IRR of the project (because at this point the NPV is zero).

The presentation of the NPV-curve has the advantage that it shows (1) the relation between project worth and discount rate. Besides, in exceptional cases two IRR's may be encountered in a project, when alternating streams of costs, benefits and costs occur. The NPV-curve will plot both IRR's! Most important, however, is that (2) NPV-curves of different projects can be presented in one figure, facilitating project selection. A third advantage is that the (3) profile of the curve tells something about the sensitivity of the project to a correct estimation of the discount rate. A steep curve reflects a project where a small change in the discount rate can seriously affect the outcome of the appraisal, whereas a flatter curve points at a less sensitive project.

An example of two NPV-curves is presented in figure 9 and based on two fictitious projects A and B with the following Net Cash Flows:

Project A		Project B	
year	Net Cash Flow	year	Net Cash Flow
0	-150	0	-225
1	0	1	20
2	20	2	35
3	40	3	50
4-10	50	4-10	60

As has been explained before the projects will be acceptable as long as the NPV-curve of a project is above the X-axis. This means that Project A is acceptable when the interest rate is below 18.7%. For project B the maximum interest rate before rejecting it is 16.6%. The graph also facilitates a comparison between the projects when they are mutually exclusive (see also section 6.2.): project A is then preferable below 10%, project B above this rate. The rate at which the lines cross (in this case 10%) is called the switching value. At this point the financial analyst will be indifferent as to which project to recommend.

6.2. Mutually Exclusive Projects.

In many cases a project analyst will just be asked for advise on the acceptability of a project. This means that he or she can recommend to accept or reject the project using any of the (discounted) measures of project worth. However, there will also be cases where a choice has to be made between two or more projects, because for a specific reason only one project can be implemented. The projects may all be acceptable from a financial point of view, but the best has to be chosen.

This element of choice enters when we are dealing with mutually exclusive projects - projects of such a nature that if one is chosen, the other can not be undertaken (Price Gittinger, 1982:373). This can be caused by budgetary constraints (budget is sufficient for only one project), because several projects want to make use of the same location and only one can be located at that site, but the concept also refers to different scales of the same project, different technologies applied and/or different moments of implementation. In all cases the question will be raised: which project (alternative) to choose?

There are two methods to choose between mutually exclusive projects. The easiest one is simply to use the Net Present Value as a decision criteria, as this measure tells the amount of wealth to be created by each of the appraised projects. The NPV is preferable to the IRR or the BCR for direct comparison between projects. Applying these measures can lead to an incorrect investment advise. For instance, a small project with a high IRR may prevent the implementation of a larger alternative with a lower IRR. The larger project variant may however create more wealth in absolute terms (NPV) and should in that case be selected instead of the smaller, more remunerative one. Plotting NPV curves of the alternatives to choose from may prove very helpful in this respect.

The alternative method is based on either the NPV or the IRR decision rule and starts with the cash flows of the mutually exclusive projects. The cash flow of the smaller alternative is now subtracted annually from the cash flow of the larger project. The resulting 'stream of differences' is then discounted to find the NPV or the IRR of this stream. If the NPV of the stream of differences is positive or the IRR above the cut-off rate, then the larger alternative should be chosen. In other words: it pays to expand the project to a larger alternative, because the expansion itself (which can be seen as a separate project) shows an acceptable rate of return. This method can be explained by referring to the fictitious projects A and B from section 6.1., B being the larger alternative of the two. In table 8 the calculation is displayed, assuming a 12% discount rate.

Table 8. Choosing between two mutually exclusive projects.

year	Net Cash Flow Project A	Net Cash Flow Project B	Difference (B-A)	DF/PWAF 12%	Difference (discounted)
0	-150	-225	-75	1	-75
1	0	20	20	0.893	17.86
2	20	35	15	0.797	11.96
3	40	50	10	0.712	7.12
4-10	50	60	10	3.248	32.48
				NPV=	-5.58

From the table above it is clear that if 12% is the correct discount rate the smaller version of the project (project A) should be chosen, as the expansion of A into B ensues a negative NPV. This, of course, could also have been seen directly from the NPV curves of both alternatives (Figure 9).

6.3. Sensitivity Analysis.

A project appraisal is always based on guesses, estimates or projections of future costs and benefits. No matter how 'educated' these guesses are, they will always carry some degree of uncertainty. Future events can never be fully foreseen. Prices of inputs and outputs may change, yields may be disappointing, there might be a significant technological breakthrough etc. For these kind of reasons can a measure of project worth in project appraisal never be more than an approach to the ultimate worth (ex post) of a project. This can not be avoided, but one can indicate how sensitive a project is to changes in certain items (cost increase, delay in implementation, change in interest rate etc.) through sensitivity analysis. It is a customary step in project appraisal to analyse how sensitive a measure of project worth is to increased costs, reduced benefits and other changes.

Sensitivity analysis makes an assessment of the influence of changes in important items on a measure of project worth and by doing so it will assess whether 'conservative' outcomes will have a major influence on the project's worth. The technique starts from the calculation of a measure of project worth, normally the NPV or IRR, based on the best estimates of costs and benefits. Conservative or optimistic estimates of benefits and costs should be avoided, as they will distort the comparability between projects. From there on two methods exist.

The first method is rather straightforward in that it just changes one or a few items and then recalculates the measure of project worth. The analyst can then see how much the indicator was affected by the change(s). From the notion of time value of money it will already be clear that changes in 'early items' (like investment costs) will modify the NPV, IRR or BCR much more than items that are important in later years. An analyst should select those items that in -his view- are not unlikely to face adverse changes as compared with the original, best estimates.

② The second technique in sensitivity analysis makes use of the notion of 'switching value'. It determines the change of an item that makes a project no longer acceptable (NPV = 0). The maximum allowed change is called the switching value and can be expressed as a percentage of the original value of an item. This percentage will give an indication of the sensitivity of a project to changes in the value of that item (for calculation see example below). An overview of the percentages items are allowed to change is presented in a sensitivity table.

After the sensitivity analysis one may ask how likely it is that changes of such a magnitude occur that make a project no longer acceptable. In most cases this will be guesswork, although risk and probability analysis may be helpful in this respect. Risk and probability analysis however are not part and parcel of 'normal project appraisal' and are usually only applied for larger, more complex projects. In addition, it generally requires the use of computers.

The calculation of the switching values and the maximum percentages of change can make use of the following formula, as long as annual streams of costs and benefits are more or less equal:

NPV = -INVESTMENTS + (average ANCF x PWAF)

in which ANCF = Annual Net Cash Flow

PWAF = Present Worth of an Annuity Factor

To calculate the sensitivity of a project one should set the NPV at 0 and give one of the other items in the equation the symbol x. The value of x can subsequently be determined using the formula above. If a project is less straightforward, and has fluctuating benefits and costs, then one might have to fall back on the normal formula for the NPV:

NPV = -INVESTMENTS + (net incremental benefits yr.1 x discount factor yr.1) + (net incremental benefits yr.2 x discount factor yr.2) + ...+ (net incremental benefits yr.n x discount factor yr.n).

The following example may illustrate the procedure. Suppose a project with $ 1,000 investments, an average annual cash inflow of $ 400, an average annual cash outflow of $ 200, a life of 20 years has to take a discount rate of 10% into account. The PWAF for 20 years and 10% is 8.513. The NPV can be calculated as -1000 + (200 x 8.513) = $ 702.6.

To assess the sensitivity of this project for changes in investment costs one can ask the question to what extent the investments may rise before the NPV becomes zero. Following the formula above this is:

NPV = 0 = -INVESTMENTS + ([400 - 200] x 8.513)

= - x + (200 x 8.513)

x = 200 x 8.513

= 1702.6

This means that the investments may rise to $ 1702.6 before the project is unacceptable. This denotes a change of $ 702.6, which is 702.6/1000 = 70.3% of the original value. Other items like cash inflow, cash outflow, discount rate and project life can be determined in a similar way, resulting in the following sensitivity table:

Investments	- 70.3%
Cash Inflow	- 20.6%
Cash Outflow	- 41.3%
Discount Rate	- 92 %
Project Life	- 63 %

This project is most sensitive to changes in the cash inflow: a 20% change makes it unacceptable. This leads to the conclusion that a firmer estimate of the benefits might be needed before taking a final decision about the project.

7. COST-EFFECTIVENESS ANALYSIS.

Cost-Effectiveness Analysis (CEA) is a variation to Cost-Benefit Analysis as presented in the preceding and subsequent sections of this paper. The difference lies in the fact that in cost-effectiveness analysis the benefits are not valued -they might be intangible-, but that instead an estimation is made for the non-monetary performance of the project. Cost-effectiveness analysis is used in situations where Cost Benefit Analysis is inappropriate due to too many uncertainties in the quantification and valuation of the benefits of a project. In contrast to the project-efficiency measures of Cost-Benefit Analysis, as calculated in for instance the IRR or the Benefit-Cost Ratio, Cost-Effectiveness Analysis looks at the degree to which the goals are obtained relative to the costs involved. In short, Cost-Effectiveness Analysis evaluates the effectiveness of a project in relation to its costs, where effectiveness is defined as the degree to which the project objectives are or will be achieved (Delp et al., 1977). CEA is particularly useful in situations where alternative project designs exist for reaching certain project objectives. Projects will then be ranked according to their cost-effectiveness. There is however not one single method to apply this criterion and rank the alternatives, but in fact three variations exist:

1. by least cost: a minimum required level of effectiveness will be determined and that alternative that meets this requirement at least cost will be selected.

2. by maximum effectiveness: a maximum amount of costs will be determined and that alternative that will be below this cost-line and shows the highest degree of effectiveness will be selected.

3. by a combination of costs and effectiveness: both a minimum effectiveness level and a maximum cost level will be set and that alternative that meets both requirements and lies farthest from the point where the two level-lines cross will be selected (see figure 10).

A Cost-Effectiveness Analysis involves the following steps:

(1) Selection of a measure of effectiveness. The broad overall goals and objectives of a project have to be translated into measurable and quantifiable sub-objectives. The quantifiable sub-objective that gives the best characterization of the whole project should be selected as a measure of effectiveness. For instance, in an agricultural extension project aiming at a change in farming practices one might think of the percentage of the farmers in the area that will change their practices as a measure of effectiveness. As this is hardly foreseeable from the outset another measure like the number of hours that farmers will receive extension messages might be more appropriate.

(2) Construction of an effectiveness scale. Once the measure of effectiveness has been determined it should be translated into units of measurement and into a range or scale of effectiveness. For instance, in the extension example above, the unit of measurement will be the number of contact hours between extension agents (or their assistants) and farmers per year or per month, while the range may vary from 0 to the likely maximum number of hours in case. Typically, however, a range will be set from 0 to 100% or from 0 to 1. A transformation may in such instances be an element of the procedure.

(3) Analysis of the alternative project designs for their effectiveness and costs. Of each alternative the effectiveness should be estimated, using empirical data where possible (experience from other projects) or pooled expert judgments. In the same extension project one can think of various designs: a training and visiting system to as many farmers as possible, the use of contact farmers, who will receive intensive attention and in return are required to pass the message on, or even an extreme reliance on radio messages. Each of the different "message hours" will require a different "conversion factor" to the effectiveness scale as a radio message may not be as convincing as a personal visit by an extension agent. All costs involved (cash outflows) of the alternatives have to be listed and where applicable discounted. For all alternatives then a degree of effectiveness and the total costs involved have been determined.

(4) Ranking of alternatives. On the basis of (3) the ratio of effectiveness to costs can be calculated, i.e. the value of effectiveness divided by the costs involved. For instance in the extension project the "total message hours" (weighed of course for the intensity of the message) of the various alternatives will be divided by the hourly costs involved. The highest ratio points at the most cost-effective alternative. There may, however, be a cut-off level determined for minimum effectiveness, for maximum costs or for both. Alternatives that fall below the minimum level of effectiveness and/or the maximum cost level should be ignored. For the extension project it may very well be that the alternative which relies heavily on radio-messages may be the most cost-effective, but that its overall effectiveness will be below the standard set. Plotting the results in a graph of effectiveness versus costs may be a very helpful device in decision-making among alternatives (see figure 10 for a sample graph).

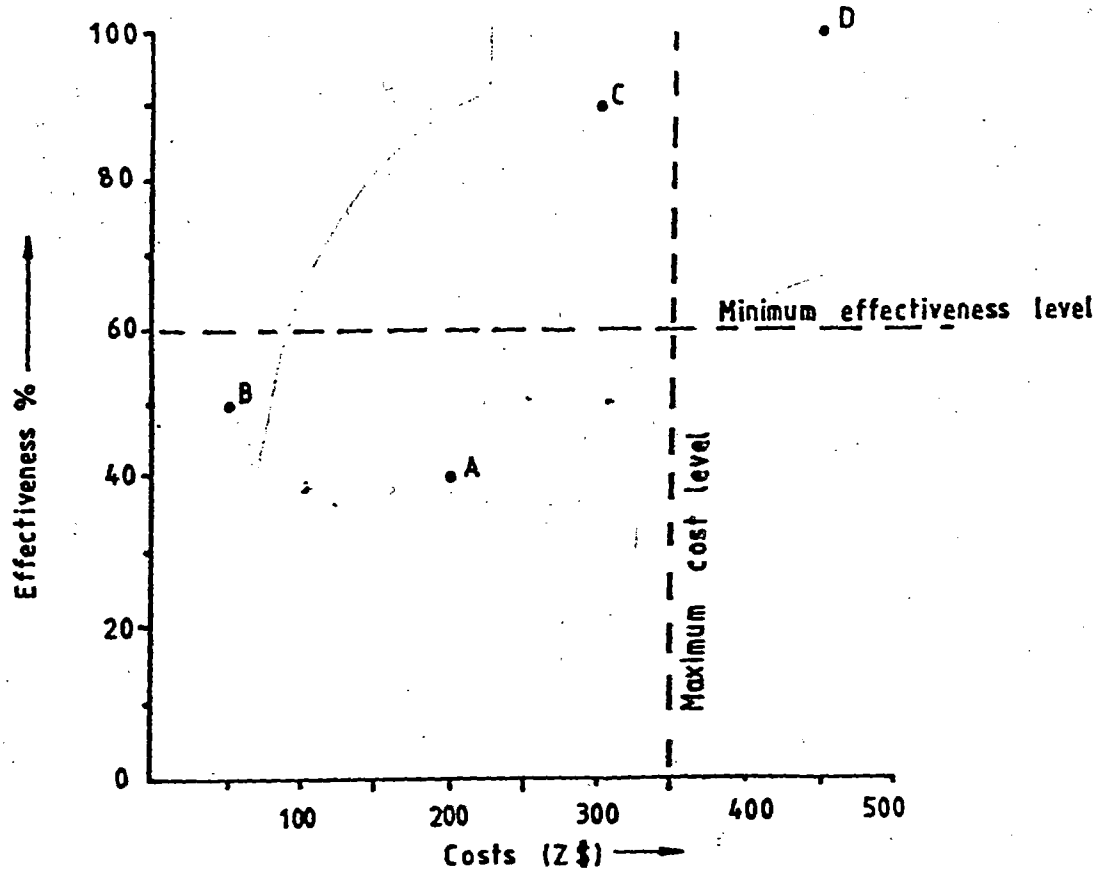
(5) Sensitivity test. Like in Cost-Benefit Analysis the sensitivity of outcomes can be tested in Cost-Effectiveness Analysis. One can set a minimum required ratio and determine the percentage change that is allowed in cost or effectiveness items before the alternative becomes

unacceptable. Or one can calculate how a certain change in either effectiveness or costs of an alternative will influence the outcome (ratio). A project alternative that is very sensitive to changes in one or more key-items may then be re-examined or even rejected although initially its ratio of effectiveness to costs may have been quite acceptable.

Table 9. Effectiveness and costs of four fictitious projects.

Alternative	Effectiveness	Costs	Ratio: Effectiveness to Costs
A	40%	200	0.20
B	50%	50	1.00
C	90%	300	0.30
D	100%	450	0.22

Figure 10 Sample plot of a cost-effectiveness graph of four fictitious project alternatives



From the graph and the table it clearly shows that A is the least attractive alternative, But how to rank B,C and D? One can simply apply the ratio and list B on top. A minimum effectiveness level might however been set, say at 60% as is depicted in the graph, which would rule alternative B out. C and D both meet this requirement, but C does it at least cost. Therefore alternative C will be selected. This will be even more obvious when a maximum cost level of 350 Z$ will be included in the analysis, ruling D out.

Although Cost-effectiveness analysis is fairly straightforward and can be used in a wide array of project proposals, a few limitations exist that need to be mentioned:

(1) only projects with the same objectives can be compared. Different project objectives will lead to different scales of effectiveness, making a significant comparison impossible. In other words: one needs similar objectives, leading to a similar scale of effectiveness;

(2) in some cases more than one measure of effectiveness can be determined for a single objective. For instance in social work projects it is often impossible to come up with one indisputable measure of effectiveness. In such cases the measures are open for debate or it might be that two different, but perfectly acceptable measures can be found that result in a contrasting ranking of projects;

(3) CEA only considers the internal side of a project, by focusing on the way the objectives are arrived at. It does not take explicitly into account the wider environment and therefore also not the secondary costs and benefits, like the economic appraisal of projects in Cost-Benefit Analysis (see section 8.). A decision maker can of course regard this issue separately, but one should be aware of the fact that it is not implicitly included;

(4) there is not one single method of ranking projects according to cost-effectiveness, as outlined in the first part of this section. One should decide whether effectiveness, costs or a combination of the two plays a critical role in project appraisal.

Sometimes a simplified variant of Cost-Effectiveness Analysis is proposed: the least-cost method. This method concerns a listing of a number of project alternatives and calculating the costs involved in each case. The least-cost solution will then be chosen. The method is built on the doubtful assumption that all alternatives reach the objective(s) concerned in an equally satisfying way, and should therefore be handled with care.

8. BEYOND FINANCIAL APPRAISAL.

So far this paper has dealt with techniques to be applied in financial project appraisal. In doing so, it hardly raised questions like 'who is appraising the project?' and 'with what objective in mind is the appraisal performed?'. However, it will be clear that it makes an enormous difference whether one expects a project to be profitable in itself or to be contributing to the overall development of a country or region. This distinction is also central to the difference between financial appraisal of projects on the one hand side and economic and social appraisal on the other. In financial appraisal one considers the point of view of the owners or promoters of the project and assesses whether it is a profitable venture or not. In other words: one is concerned with the financial viability of the project itself. Wider effects to society are not taken into account.

Nevertheless, financial costs and benefits can give an incomplete picture of the costs and benefits to society at large. If one is appraising a project from the societal point of view one is investigating what kind of effects a project brings about in society at large. One is not merely interested in the projects profitability, but more in its contribution to the national welfare or well-being. This implies that questions are raised like 'how much does the project contribute to the Gross Domestic Product?', 'how are costs and benefits distributed over the various social groups or regions in a country?', 'how does it affect the balance between consumption and investments?' and 'in which way does it affect the natural environment?'. In answering these kind of questions basically two fields of study have emerged. On the one hand side a whole body of theory emerged in the 1970's on what is called 'economic and social project appraisal'. This was basically written by economists, who tried to incorporate national or macro economics into project appraisal. The 1980ies, on the other side, saw a new field of study appearing: project impact assessment, to which sociologists, environmentalists, geographers, and regional economists contributed. The main concern was to give an overall picture of the changes or effects that a project may have to nature, society and/or the region it is located in.

This section will deal with both aspects. It starts with some principles in economic and social project appraisal and presents the consequences of the outcomes of these types of appraisal. Then it devotes some attention to project impact assessment, in which environmental, societal, and regional-economic impacts are discussed. The discussion is necessarily introductory in nature, as both fields of study are rather wide and complex. However, many good textbooks exist that may take the reader further in his or her studies. The bibliography at the end of this paper may provide a good starting point.

8.1. Economic and Social Costs and Benefits.

The moment one shifts the focus of the appraisal from the private to the national point of view, one has to make a number of adjustments to the items and the prices included in the analysis. Secondary costs and benefits need to be included. In addition market prices may have to be adjusted, while a rectification needs to be made for transfer payments. This is done in both economic and social project appraisal. Economic appraisal assesses the contribution of a project to the national income. It is therefore concerned with the efficient allocation of resources in the national economy and makes use of economic or efficiency prices. Social project appraisal is a variation to this and takes value judgments with respect to distributive effects into account. In this case a slightly different set of accounting prices is used (social prices).

The adjustments mentioned above can be grouped under the following four headings:

(1) Exclusion of transfer payments. Payments of taxation for instance is a cost to the owner or the care-taker of a project, but not to society at large. It merely represents a transfer of funds from one individual or organisation (project) to another (government). The society at large does not gain or loose by this transfer of money and the national income is not affected by it. Taxation is therefore excluded from the economic and social analysis, just like its opposite: government subsidies. Also cost and income items that relate to the financing of a project have to be omitted as long as the payments (loan, repayment of principal, interest payment) are made within the society. In that case, society's wealth is not affected by the transfer of money. External financing may benefit or harm the nation involved, therefore affects the national income, and consequently needs to be included in economic and social appraisal.

(2) Inclusion of secondary benefits and costs. Benefits and costs that do not accrue to the project itself -the secondary benefits and costs or indirect effects- are not accounted for in financial analysis. They are nevertheless real benefits and costs to society and need therefore be included in economic and social project appraisal. Examples of these items are:

* Technological spillovers. When a project involves the introduction of a new technology, people outside the project may also get acquainted with and adopt this technology, leading to an overall rise in productivity. The expected net gain in national income from this spillover then needs to be included in the appraisal.
* Cost increases or reductions to users of a service. In a road improvement project, for instance, a reduction in maintenance costs of vehicles that make use of the road can be expected. This reduction in costs is a benefit to those users who are part of society and therefore to society at large.

* Increase or decrease in consumer surplus. When as a result of a project the rate for a service (for instance for water or electricity) is set or changed, the consumers as a group face a certain surplus or a change therein. This consumer surplus can be defined as the difference between the amount of money that the aggregate group of consumers is willing to pay for the service and the amount they actually have to pay. This difference or the increase therein can be seen as a benefit to the consumers and therefore for society at large. A decrease must likewise be accounted for as an economic or social cost.
* Competition effects. If a project introduces an (efficiently organised) activity that elsewhere in society is done in a more traditional way, the latter may well be outcompeted by the new project. The resultant losses in output and/or employment have to be accounted for in economic and social appraisal.
* Environmental effects. Many projects influence their natural environment in a positive or negative way. These effects are hardly ever charged or credited to the owners or organisers of a project. Nevertheless pollution of water, land or air, erosion etc. are costs to society and need to be taken into account in economic and social appraisal (see also section 8.4.).

Many of these secondary costs and benefits are hard to value in monetary terms. They must however be included in economic and social analysis, if not in quantitative, then at least in qualitative terms.

(3) Adjustment of market prices. For a variety of reasons market prices may not reflect the true (scarcity) value of goods, services and factors of production to society. In economic appraisal they need to be adjusted in such a way that they do reflect the true scarcity of commodities. The resulting (accounting) prices are called economic or efficiency prices. If these adjustments were not made one would allocate too high or too low prices to commodities from the point of view of society, leading to incorrect decisions about projects. If onnnefor instance, applies the market wage rate in cases of unemployment, one is valuing the costs of labour too high from the national point of view. The national costs of employing labour in a project is the output foregone by the workers in case the project would not have been there. This is likely to be far less than the value of the wage. In such a case one might have been inclined to reject a proposal involving a substantial labour component, if one had not adjusted for the price of labour.

Market prices may differ from economic prices due to various market distortions or imperfections. These distortions and/or imperfections result from amongst others:

* monopolistic or monopsonistic marketing structures, causing prices to be higher or lower than in free market conditions;

* government price and wage controls;
* import quota, tariff systems and foreign exchange allocation systems;
* unemployment, causing wages (especially for unskilled labour) not to reflect output foregone in other situations;
* imperfect information about purchasing and selling options in the market.

As perfectly free markets and therefore market prices that truly reflect the scarcity relations in society are nowhere to be found in the world, a recalculation of market prices is an imperative, but complicated step in economic and social appraisal. very urgent/important.

These three steps mark the difference between financial and economic appraisal of projects. If in addition one is concerned with "social" effects of projects, a fourth step can be taken:

(4) Assignments of weights to various effects or goods. A government may have spelled out a political or strategic preference for certain effects or goods. One can take these value judgments into account by assigning weights to certain effects or goods. If for instance a government is politically in favour of distributing income more equally over the population one might give a lower weight to wages earned by low-income groups. This will artificially reduce the accounting price for wages and thereby will make project proposals that involve the employment of low-income groups more attractive.

An adjustment for the following effects or goods can be made:

* Distributive effects. Project effects that affect certain socio-economic groups or regions may be favoured or discouraged by the assigning of weights.
* Timing of effects. The government may favour for instance savings above consumption (i.e. consumption in the future above immediate consumption) and therefore include it in its recalculation of benefits and costs.
* Merit and demerit goods. Some goods and services may be valued highly by government because of their strategic character or because of the prestige they offer. One might think of goods as a National University, a National Airline or a steel mill as 'merit goods', while for instance alcoholic drinks may be seen as 'demerit goods'. In social project appraisal one can adjust for these kind of preferences.

The assignment of weights to prices is also a rather complicated process and above that extremely tricky and value loaded.

Once all relevant items are found and priced properly (see 8.2.) a measure of project worth can be calculated. This might be the NPV or BCR at accounting prices, but moreoften one will find in projects that the IRR is presented. The IRR calculated at

economic prices is called the Economic Rate of Return (ERR), while the Social Rate of Return is the same measure determined at social prices.

8.2. Finding Economic Values.

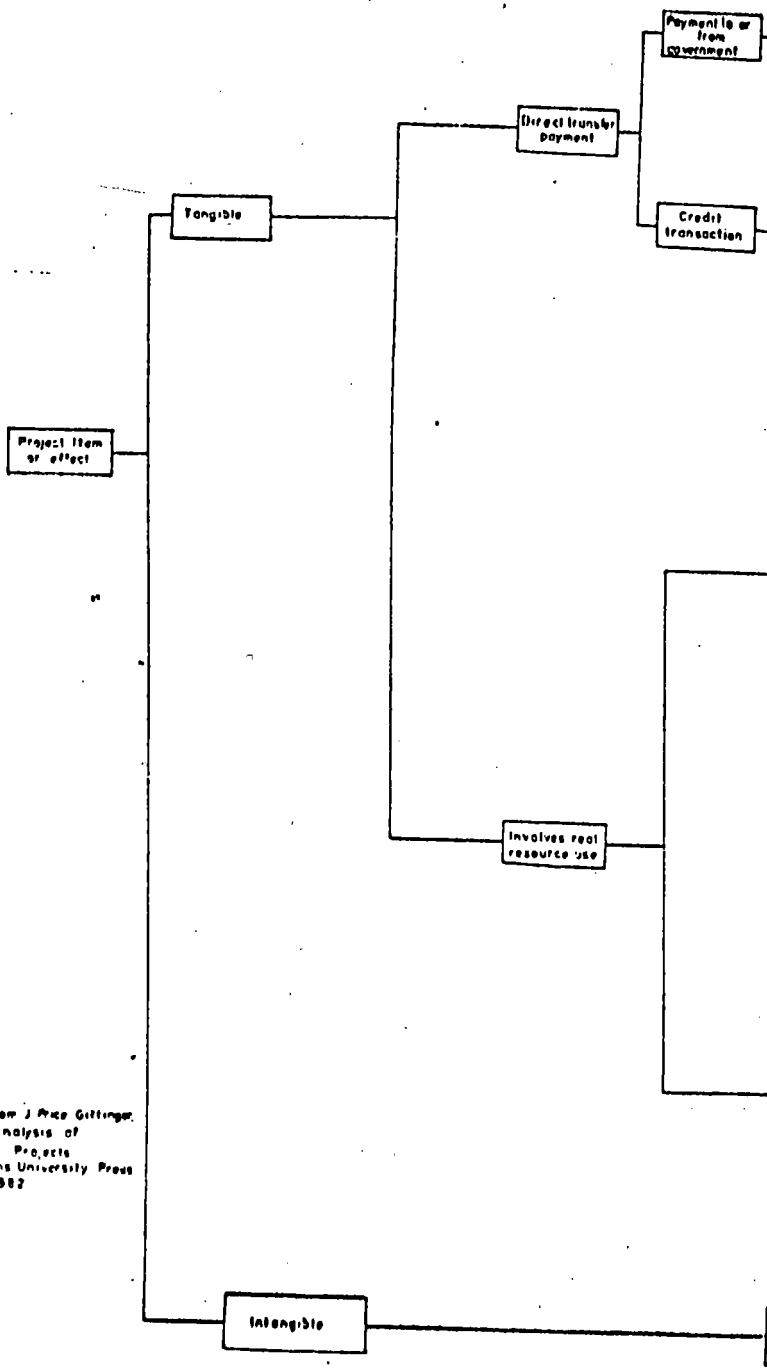
As has been stated before market prices in a country or region do not always represent their correct (scarcity) value to society. The proper measure to look at in economic project appraisal is therefore the extent to which the real national (or regional) income changes and will be expressed in economic prices or opportunity costs. Opportunity costs are the costs for a good or service in its (next) best alternative. Other words that are repeatedly used for economic prices or opportunity costs are: efficiency prices, scarcity prices, accounting prices and shadow prices. In principle the last two refer to every price that is not a market price, but here they are used in the sense of 'economic value'.

The finding of economic prices can be a rather cumbersome and complex process and it should be borne in mind that it is not always worth the effort. Some projects can be accepted or rejected on the basis of a financial appraisal in combination with common (economic) sense. For instance if a project, where the major input is unskilled labour, shows a high Financial Rate of Return and if one knows that the wage rate for unskilled labour is considerably overstated in comparison to its opportunity cost, than it is rather obvious that the project will also be acceptable in economic terms.

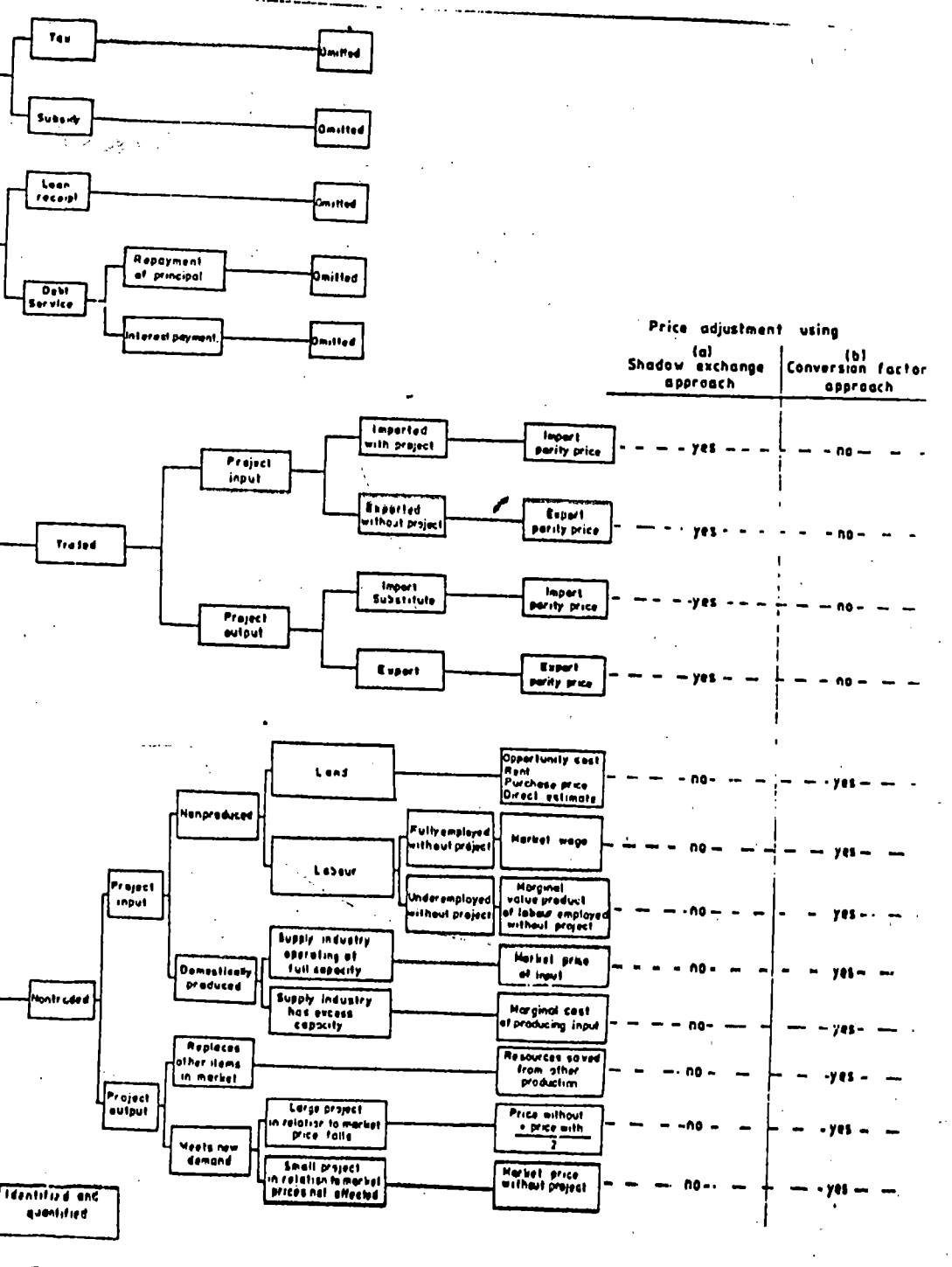
Figure 11 provides a decision-tree for the determination of economic values. The diagram is adapted from J. Price Gittinger (1982) and may be a useful aid when a project analyst has stated all possible items of value to society that follow from a projects activities. For each item the tree can be traced to find whether the item should be omitted or adjusted, and if so in which manner.
In this section some important elements of the tree will be briefly explained. It should be borne in mind that this explanation does only touch at many of the complicated issues involved. In dealing with efficiency pricing one enters core issues of economics and a lot of controversy exists towards the definition and determination of these prices.

If the local market price for a good or service is a good reflection of its scarcity value in society, then of course no adjustment is needed to obtain the economic price. In those cases the market price is equal to the scarcity price. In other cases it might be that the market price was established in a free market situation, reflecting the scarcity value of the item, but that due to indirect taxes or levies the actual price was somewhat higher than would have been without government interference. To find the economic price in those cases one

Figure11 - Decision Tree for Economic Valuation



Source, Adapted from J Price Gittinger
Economic Analysis of
Agricultural Projects
John Hopkins University Press
Baltimore 1982


Tax
Omitted
Subsidy
Omitted
Loan receipt
Omitted
Debt Service
Repayment of principal
Omitted
Interest payment
Omitted
Price adjustment using
(a) Shadow exchange approach
(b) Conversion factor approach
Traded
Project input
Imported with project
Import parity price
yes
no
Exported without project
Export parity price
yes
no
Project output
Import Substitute
Import parity price
yes
no
Export
Export parity price
yes
no
Nontraded
Project input
Nonproduced
Land
Opportunity cost
Rent
Purchase price
Direct estimate
no
yes
Labour
Fully employed without project
Market wage
no
yes
Underemployed without project
Marginal value product of labour employed without project
no
yes
Domestically produced
Supply industry operating at full capacity
Market price of input
no
yes
Supply industry has excess capacity
Marginal cost of producing input
no
yes
Project output
Replaces other items in market
Resources saved from other production
no
yes
Meets new demand
Large project in relation to market price falls
Price without project / price with project / 2
no
yes
Small project in relation to market prices not affected
Market price without project
no
yes
Identified and quantified

simply has to subtract the tax or levy from the market price (as being a transfer payment) to find the economic price.

In many cases however the market price differs from the scarcity value to society for many interrelated reasons. To make corrections for all the factors involved is virtually impossible and one therefore has to rely on an estimation of the opportunity costs for those items. Opportunity costs for tradeables and non-tradeables are found in different ways. The term 'tradeable' is used when a good or service enters international trade or is potentially able to do so. Non-tradeables refer to those items that can not be traded outside the country or region, due to their nature or to prohibitive transportation costs. Land is a good example of a non-tradeable; extremely perishable products or products that are heavy compared to their value (bricks) provide other examples.

For tradeables the estimation is usually based on the assumptions that in its best alternative use the goods and services may be traded on the world market and that the world market for that item is a free and relatively competitive one. The price on the world market (normally in US $) then has to be converted into the domestic currency and valued at the project location (import or export parity price). This includes the addition of transportation or distribution costs from the point of entry in the country to the project site. Import duties have to be excluded from the price, as they represent transfer payments from the project to the government. For exports the argument goes largely similar: one obtains the price on the world market, subtracts the transportation costs from the project location to the point where the product leaves the country and, again, one excludes export taxes or levies (transfer payments).

For goods that are not traded, but are potentially tradeable, the same principle applies. If the item is an input to the project and obtained on the local market, but would (potentially) be exported without the project, than its opportunity cost is the export parity price. That is the price that would have been obtained if the item was sold on the world market, adjusted for the costs between the project boundary and the point where the price is quoted (f.o.b.). If the item is a project output and could have been obtained from the world market, than the import parity price has to be taken as a reflection of the opportunity costs. The import parity price is the price (c.i.f.) at the point of entry, adjusted for costs of transportation, distribution and/or marketing to the project boundary.

The most delicate problem in this exercise is the conversion from the price in foreign currency into domestic currency. The Official Exchange Rate (OER) is in many cases not a correct reflection of the value of the national currency. In quite a number of countries the currency is not freely convertible and the Official Exchange Rate is therefore not more than an estimation of its value on the international money market. In just as many cases the value of the domestic currency is overvalued, making the Official Exchange Rate overvalued. If one

would not adjust for this situation and simply use the OER to convert the price of a good from (for instance) US dollars to Zimbabwean dollars, then such an item would appear to be too cheap when expressed in Zimbabwean dollars. This then could result in a situation where imported items are valued too low in comparison to domestic products. The consequence would be a distortion in favour of import intensive (and therefore in many cases capital intensive) projects.

But how to find the correct value of the national currency or the Shadow Exchange Rate (SER)? It has been argued that the black market or unofficial money market gives an indication of the real value of the domestic currency. It certainly is a symptom of an incorrect OER, but for two reasons it can not be applied as the SER. First, those who operate on the unofficial money market face a certain risk and want to be rewarded for it. Second, only a part of all foreign exchange transactions can take place on this market, as official transactions need to be recorded and will be dealt with at the OER. A better alternative of finding the SER is to determine the average level of import and export duties and to find the weighted average of both. If for instance the OER of the Zimbabwean dollar is US$ 1 = Z$ 2 and the average import duty is 20%, then the Zimbabwean purchaser of an imported item of one US dollar will pay on average Z$ 2.40. In other words: the value of items at the world market for Zimbabweans is Z$ 2.40, or one might say the unofficial value of the US dollar is Z$ 2.40 instead of Z$ 2. To find the overall SER the same calculation needs to be done for export duties, and subsequently the import and export SER need to be weighed according to the value of total exports and imports. In normal situations a project analyst is not required to go through this exercise. The National Planning Agency should be in the position to provide him or her with the correct SER. It is even not advisable to repeat the computation of the SER in various projects, as it disturbs their comparability.

Once the SER is known, the economic price of a tradeable can be established. In literature two approaches are prevalent. The first uses the SER straightaway, while the second converts the SER in a Standard Conversion Factor (SCF). In the first method one finds the economic price of a tradeable simply by taking its price on the world market (c.i.f.) in foreign currency, and multiplying it with the SER. Subsequently the costs of providing the item at the project location need to be added (imported item, project input) or subtracted (exported item, project output).

An example may clarify this. Suppose a car has a (c.i.f.) value of US$ 10,000, and the SER is US$ 1 = Z$ 2.40 as presented above. Transporting the car to the project site will cost Z$ 200 in addition, while a charge for domestic handling and marketing will be Z$ 300. The economic price for the car will then be (10,000 x 2.40 =) 24,000 + 200 + 300 = Z$ 24,500.

SER ⇒ Shadow Exchange Rate

The alternative method makes use of a Standard Conversion Factor (SCF). This SCF has a close relation to the SER in the sense that it can be expressed as:

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

Or in the example above, when the OER is US$ 1 = Z$ 2 and the SER is US$ 1 = Z$ 2.40, then the SCF is 2.00/2.40 = 0.833. The economic value of an item can be determined by using the border price expressed in foreign currency and applying the OER; the non-traded elements have to be multiplied with the SCF.

For the car of US$ 10,000 the economic price in Zimbabwean currency would be, assuming that the domestic costs relate to non-traded items: 10,000 x 2.00 + 0.833 x (200 + 300) = Z$ 20,000 + 417 = Z$ 20,417. Note that this value is considerably lower than the one presented before, when the method based on the SER was used. The difference can be explained by noting that the "SER-method" expresses the value of traded items in non-traded terms and thereby increases the value of traded items as stated in domestic currency. The "SCF-method" on the other hand expresses the value of non-traded items in terms of the traded ones, and by doing that reduces their value as expressed in domestic currency.

The first method (based on the SER) was described by the UNIDO (1972 and 1978) and is named after this organisation. The second method (based on the SCF) is proposed by Little and Mirrlees (1974) and Squire and Van der Tak (1975) and is widely referred to as the LMST method. The LMST method can be extended to include all kinds of specific conversion factors for non-traded goods, and thereby making it more refined. Although the two methods are in principle comparable, one should choose either of the two, according to the practice in the country concerned.

Finding economic prices for costs and benefits of <u>non-tradeables</u> is more complicated than for tradeables, as a simple comparison with the world market price is out of question. Instead, in general for non-tradeables one has to rely on the principle of opportunity costs. The way these opportunity costs are valued of course depends on the method adopted. The SER (UNIDO) approach does not change the opportunity costs, as traded items are expressed in terms of non-traded ones. The conversion factor (LMST) approach, on the other hand, requires a multiplication by the SCF or an appropriate conversion factor, once specific conversion factors are used. The way the opportunity costs are attained differs for various goods, services and factors of production.

Some rather large projects, especially in industry, transport or services, may produce outputs that cause the price of the output to fall. This might for instance be the case when a new fertilizer plant will be established, that will produce in bulk, and may offer the product at a lower price than its competitors. In this case the economic price is not the old (higher) market price, neither is it the new (lower) one. Rather the price

halfway in between will be taken as the economic price. The argumentation for this is as follows. A number of people have been prepared to buy the fertilizer at the higher price, for them this price could be seen as the opportunity costs. Other people only entered the market after the price decreased, for them it was either the lower price or nothing. In other words: the new price is a good reflection of their willingness to pay for the fertilizer. The economic price for project appraisal obviously is somewhere in between. As the exact demand curve for an item is rarely known, one generally assumes it to be linear and descending at 45 degrees. The economic price then appears to be exactly in between the higher and the lower market price.

A warning note should be made when there is excess capacity in the economy. If, in such a situation, a project requires an input from an underutilised industry, then its economic value clearly is not reflected in the market price. The costs to the nation of producing one extra item in an excess capacity situation is only the variable production costs for that item (due to extra labour, energy and inputs). It does not include an allowance for the fixed costs. Neither is it accurately expressed in the average variable costs. Rather one has to value the item at economic costs by finding the marginal variable costs!

Land is a non-tradeable item that often enters the appraisal. The economic valuation of land depends on the character of the land market and the specific piece of land to be valued. If there is a well developed land market with sufficient transactions going on, then either the purchase price of the land or its rental value may be taken as its economic value. In situations where this is not the case and one can not find a good example of a transaction of a similar piece of land, one has to rely on direct estimates of the productive capacity of the land. This means that one has to assess the value of the output of the land (at economic prices!) in its best alternative use that would have been likely without the project. In a new land settlement project on 'idle land', the most likely alternative might be waste land. Except for the costs of clearance no other economic costs would therefore appear in the project appraisal. Moreoften, however, land will have a specific use with a certain economic value. In those cases the opportunity costs can be assessed by an estimation of the net production forgone. This is the value of the output in its alternative use minus the value of the inputs and a remuneration for the other factors of production involved - labour, capital, management.

For labour one can hardly speak of the existence of 'one labour market'. Instead, several labour markets may prevail side by side, depending on the skills of the labourers, the way they are organised and their geographic area of operation. In principle for each type of labour one has to look at the corresponding segment of the labour market and appraise the marginal output forgone of each worker, i.e. value of the output that the last worker adds to the total. Generally however, one only makes a distinction between skilled and unskilled labour. For unskilled labour and in cases of widespread unemployment the marginal

output of one worker is likely to be very small, in some cases even close to zero. Most economist nowadays agree that in any case it will be a positive figure, although it may be quite low. Unemployed labourers may find some kind of self-employment or work in agriculture in the peak season (harvesting or planting). Through those activities they make a contribution to the net national income and this contribution is the output forgone the moment they will be employed by the project. The economic price for labour may as a consequence be much lower than the (financial) wage paid to the unskilled labourers. For skilled labour the situation normally is different. In many countries skilled people are in short supply and it might reasonably assumed that the value of their production is expressed in their wage rate. Therefore for skilled labour the market wage will be a good approximation of the economic costs.

8.3. Economic and Social Appraisal

Once all relevant items of a project have been properly adjusted and priced the analyst can appraise its 'profitability' in economic terms. That is, the project analyst ascertains whether the project makes an acceptable contribution to the national well-being, as expressed in the real national income. As has been stated before the Economic Rate of Return (ERR) is the most widely used measure of project worth in economic appraisal. The ERR is calculated in the same way as the IRR, except that the items and prices of the economic appraisal apply. The ERR tells the analyst what the economic return (value to society) to the capital invested is. A project is acceptable when the ERR is well above the interest rate in society. But unlike the IRR one does not compare the ERR with the market rate of interest (or the discount rate), but with an Accounting Rate of Interest, the Economic Accounting Rate of Interest (EARI). The EARI is the rate at which the value of capital to the nation falls. Or alternatively: it is the opportunity cost of capital expressed in economic terms, i.e. the economic value of the marginal project. Although it might be the same as the market rate of interest, in nearly all countries and situations it will not be the case. Like many economic parameters, the EARI may be obtained from the National Planning Agency.

After performing a financial and an economic appraisal of a project one might in some instances find a discrepancy in the sense that a project may be acceptable in financial terms, but unacceptable in the economic appraisal, or the other way around. In such cases it might be the task of the government to act on behalf of society by either providing an inducement (economic acceptable project) or by discouraging or even forbidding the activity. The following scheme (figure 12) presents an overview of the outcomes of a comparison between financial and economic appraisal.

Figure 12. Financial and economic acceptability compared.

	Financially Acceptable	Economically Acceptable
Financially Unacceptable	x	society appreciates project, but no private action to be expected; gvt. may step in or provide subsidy
Economically Unacceptable	private action to be expected, although society disapproves of project; gvt. may discourage or forbid project	x

Extending the ppraisal from economic to social terms implicitly involves value judgments. These judgments relate to distributional considerations (how much value should be attached to income earned by certain socio-economic groups, by certain regions?), to consumption versus savings (as savings relate to investments, this can also be seen as consumption now versus consumption in the future), and to certain (de-)merit goods (how much value should be attached to a prestigious project like a national sports stadium?). In principle social appraisal sounds simple: one applies a system of weights for several project effects, like the degree to which low-income groups are favoured by the project, or the extent to which the project uses scarce public funds. These weights are then included in the calculation of a measure of project worth, like the IRR, to tell whether the project is acceptable in social terms or not. In practice however both the derivation of weights and their application in the calculations is a highly complicated process, which goes far beyond an introductory text. Several good handbooks are written that deal with this issue; like Little and Mirrlees (1974), Squire and van der Tak (1975), and Irvin (1978).

Nevertheless two general observations can be made about social project appraisal. First, as has been stated, social appraisal implies value judgments and is therefore not an objective method. It is highly sensitive to political priorities and can -as a consequence- also be abused by giving extremely high weights to politically desirable effects. This can result in a situation in which most or even every project that has been proposed on political grounds will be accepted. One should be suspicious if too many projects that are not acceptable on economic grounds prove top priorities after social appraisal. Second, social appraisal may affect the acceptability of a project or change the relative ranking of projects. To give an example: in many countries a more equal income distribution is an important objective. If this is expressed in the system of weights then projects that benefit the poor rather than the rich will be favoured.

8.4. Project Impact Assessment.

A separate section of this paper is devoted to project impact assessment, because it is an area of great confusion. In some project documents no attention is paid to wider impacts of projects at all, while others do include them but fall into the trap of 'double counting' of effects. In general all effects that have been mentioned under 'secondary benefits and costs' in section 8.1. are relevant to a project analyst. In fact, many of the project impacts are intangible benefits and costs and can only be qualified, sometimes quantified, but not valued.

It seems important at this stage to repeat which effects should be included in an appraisal and which should not. In general, only those effects should be assessed that are directly attributable to the implementation of the project. This means that one has to appraise what would have happened without the project, including an estimation of the likely policies and projects that will be carried out in the absence of the project under consideration. Only those effects that are different from this 'without' situation can be ascribed to the project in question and should be included in the project impact assessment.

For three areas a more specific treatment of impacts is contained in the following paragraphs, viz. Regional Economic Effects, Social Effects and Environmental Effects.

8.4.1. Regional Economic Effects.

It has been argued that projects normally have a beneficial effect on the (regional) economy in their areas of location. Through employment creation, income generation and input-output relations they are said to have an economic impact that is felt far outside the project boundaries. These effects will happen in the region surrounding the project location and could therefore be included in an appraisal from the regional or national point of view. One should however be extremely careful with these effects, as many of them can not directly be ascribed to the project and as double counting is prevalent. This can be illustrated by three commonly cited effects: multiplier effects, linkage effects and price effects.

Multiplier effects refer to job and/or income creation effects that are the result of a certain investment. The argument goes that due to an initial amount invested several 'rounds' of spending follow through which employment is created and income spread. While this is a real phenomenon which is extensively reviewed in (regional) economic literature, one can not always apply it to project appraisal. Firstly, it may be very questionable whether a multiplier effect may be attributed to a project. The employment and income generating effect may be the result of investing (spending) money anyway. Only in cases where

the absence of a project will also lead to the absence of investments of a similar amount of money in an alternative way in the region involved, may one consider the multiplier effect. Secondly, it is an effect which in literature is generally seen as a beneficial effect in situations of excess capacity (Squire and Van der Tak, 1975: 23, Bridger and Winpenny, 1983:12, Kuyvenhoven and Mennes, 1985:53). Not many developing countries are characterised by a general overcapacity in their economies. Only in case of excess capacity can an initial investment lead to several 'rounds' of spending without extra investment, as in this situation the only extra costs of production are (marginal) variable costs. If there is no general overcapacity then each dollar spent may very well require extra investment elsewhere in the economy and benefits to society will be equalled by (resource) costs. Alternatively, the income earned may leak away to imports or cause inflation. Thirdly, multiplier effects might have been accounted for by the application of an adequate 'shadow wage rate' (Little and Mirrlees, 1974: 271-272).

Nevertheless, multiplier effects do occur and projects can have growth dynamic effects in the regional or national economy through investments that would otherwise (without the project) not have happened. If that is the case, the effect should be mentioned in the appraisal.

The same argumentation holds for linkage effects. A distinction can be made between forward and backward linkages, which are the output and input relations respectively of an activity or project. Linkage effects result from an expansion of a certain economic activity and are expressed in terms of expansion (in jobs and/or output) in the activities linked to the expanding one. These effects in fact are largely similar to multiplier effects, and the same reservations need to be made with respect to their use in project appraisal. Including both multiplier and linkage effects should in any case be avoided as it is a form of 'double counting'.

A third effect, referred to as the price effect, may provide even greater problems. In general, it concerns effects on the rest of the (regional) economy due to changes in prices that result from the projects activities. For instance, a project may produce a certain item in large numbers or in an efficient way, so as to reduce its price in the market place. This will in most cases have effects on other producers (competitors), who are likely to be adversely affected. On the other hand purchasers of the product are likely to benefit. In any case, when this effect has to be added to the financial analysis, both the benefits and the costs to society of all the affected persons and groups have to be taken into account, which might prove to be a problem in itself. In addition, most if not all of the effects will have been accounted for when a proper economic price for the item has been established.

8.4.2. Social Effects.

As projects are mainly aimed at bringing about economic changes, these changes normally come with changes in social life. Attitudes, behaviour, or people's entire way of life may change due to the implementation of a project. These social effects are usually a concomitant outcome of a project and may or may not be intended from the outset. In some cases a change in behaviour is the main objective of a project or programme, as is the case with family planning programmes. In other cases may social changes necessarily result from the project's outlay. The construction of a major dam, like Kariba in Zimbabwe/Zambia or the Assuan Dam in Egypt, provides a good example. People have to move from the flooded area and build up a new living elsewhere, traditional types of farming or fishing have to be adapted, new diseases like bilharzia may become endemic etc.

Social effects are typically intangible effects. They may be specified, although even that may prove difficult, as it is hard to tell what the social changes would have been without the project. Societies tend to be transformed over time. Quantification of social effects is virtually impossible, let alone their valuation. It might also prove difficult to decide whether a social effect could be seen as a benefit or a cost. As long as the change reflects a project's objective, like in the case of the family planning programme, one can argue that it may be listed as a benefit. On the other hand, changes in social life usually mean an abandoning of (part of) a traditional life-style. Whether processes of 'modernization', or 'incorporation in a (capitalist) world culture', should be evaluated positively or negatively is of course open to personal or political value judgments.

8.4.3. Environmental Impact Assessment.

Just like social project effects deal with the social environment of a project, so is environmental impact assessment directed towards its natural environment. In view of the fast decreasing quality of the worlds nature, it is an area of great concern, and recent years have seen a mounting increase in the attention paid to environmental effects of economic actions and activities. In many European and North American countries it has become a lawful obligation to provide a report stating the foreseeable impact of an activity or project on its natural environment. In developing countries, however, the design of a methodology and of legal requirements with respect to environmental impact assessment is still in its infancy, although interest in the subject matter is growing rapidly.

The methodology of environmental impact assessment resembles that of detecting regional-economic and social effects. It starts with an initial state of reference, which can be seen as the situation of the natural environment before the project starts. As the

natural environment is made up of numerous elements in the spheres of geology, pedology, hydrology, climatology, physical geography, biology etc., it is critical to make a selection of indicators that reflect all these spheres in a nutshell. One might think of indicators like 'vegetation type', 'no. of rare species', 'soil type', 'degree of erosion' and the like. A second step is to make a prediction of a future state of the environment without the project. This is not likely to be the same as the state of reference (before project situation) as nature is constantly changing and environmental processes continually occurring. This 'without scenario' then has to be compared with the future state of the environment with the project. The difference between the two scenarios is the impact on the natural environment that is attributable to the project in question.

It is not easy to state the impact on the environment of a project. It requires specialists or in any case consultations with experts on the various fields to list the most likely effects. These effects will mainly be intangible. For instance, it seems impossible to attach a value to the disappearance of the red-winged hornbill due to an agricultural project. In other cases one may come up with estimations of the value of an environmental impact, like in an erosion control project where the agricultural production value may be ascribed to the top soil conserved by the project. For an overview of various methods to estimate the (economic) value of environmental impacts see Dixon et al. (1988). In many cases, however, one will be satisfied with an identification of the environmental effects. Its impact on decision making is then subject to personal or political value judgments.

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