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17025

Final Report
on
COMFAR Training Workshop
5 - 16 September 1988
UNIDO, Vienna

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1. The COMFAR Training Workshop was held from 5 to 16 September 1988 in Vienna. It was officially opened by the Head of the Feasibility Studies Branch, Mr. Werner Behrens and closed by the substantive officer, Mr. Lech Kurowski.

2. Six participants attended the seminar (see attached List of Participants). Two staff members of the UNIDO Feasibility Studies Branch also participated actively during the first week of the Workshop. Most of the participants were already acquainted with the principles of financial analysis and some had actually been carrying out financial evaluation of investment projects in their respective institutions. Three participants were also familiar with at least some applications of computer software programmes (writing or working with the LOTUS 1.2.3 Programmes for financial evaluation of projects). Four participants were also acquainted with (at least) the basic features of the COMFAR Financial Module. As far as the economic analysis of projects is concerned, the participants (with the exception of one) had not previously been exposed to formal training in this field. None was familiar with COMFAR's Economic impact Module.

3. Taking into account the training's general programme (the lecturer's Terms of Reference), as well as the participants' background, needs and expectations, the Training Workshop started with a very brief introduction to the project development cycle and a more developed introduction to computer hardware and the System (MS-DOS) programme (see attached Programme of the Workshop).

   The substantial part of the Workshop began with a brief description and exercises with the three financial statements (balance sheets, income statements, sources and uses of funds) and the financial ratio analysis. This part of the course served as a background to the formal presentation of the COMFAR Main System Module. The introduction to the Module and its practical application by the participants were the most important parts of the programme during the first week of the course.

   The second week of the Workshop started with an introduction to the COMFAR Graphics Module. Although the obvious advantages of the Module for presentation of the calculation results were treated at some length, the introduction concentrated on GPAFIX special features that render it particularly suitable for sensitivity analysis.

   The main topic during the second week was Economic Cost-Benefit Analysis. All participants expressed their great interest in this part of project evaluation (although one of them expressed some reservations about its applicability in his private business firm). Due to the background of the participants, some time was devoted to the general, more theoretical introduction in the use of the COMFAR ECBA Module. At the participants' request, the last day of the seminar was devoted to practical application of the COMFAR System. Three main topics were presented: collection of data and their preparation for use with the COMFAR format; interpretation of the results; COMFAR application in the expansion/modernisation of investment projects.

   The workshop was held every day from 8h30 to 16h30 (with a one-hour lunch break). All attending participated very actively in the Workshop.

4. The participants were provided by UNIDO with all relevant Manuals before the Workshop. In addition to UNIDO publications, the course lecturer had prepared and distributed on the first day of the workshop the following hand-outs:

- Introduction to MS-DOS and some MS-DOS commands,
- Introduction to financial analysis,
- COMFAR entry tables,
- Introduction to cost-benefit analysis,
- Economic analysis: value-added approach.

During the Workshop two additional hand-outs were distributed:

- COMFAR Main System schedules (to enable a detailed line-by-line presentation and discussion of the calculation results),
- COMFAR economic impact "average" entry tables.

5. The Workshop was held in the VIC Building (Conference Room II). Most of the time, six computers (Toshiba 3100/20) were available for the course participants. (One of the computers was placed at the Worshop's disposal by a participant's company). Each of the six external participants had thus constant access to his/her own computer during the Workshop. Secretarial assistance to the course was very efficiently provided by Ms. T. Rynkiewicz (Feasibility Studies Branch).

6. During the second part of the Workshop the Swedish participant submitted a formal request on behalf of her organisation (SWEDFUND) to license COMFAR, and was provided with the complete package before the end of the seminar.

7. During a summary discussion at the end of the course all participants expressed their very positive opinion of COMFAR. They stressed, among other things, the versatility and simplicity of its excecution. The participants emphasised also the simplicity and speed of the procedures for switching values (sensitivity) analysis as a very important feature which renders COMFAR particularly adaptable to practical applications.

Taking into account the future role of COMFAR trainers in their respective organisations, the participants suggested that it would be useful to include in the COMFAR Manual a set of worked examples (cases) for use by future COMFAR licensees.

The assistance provided to the course by its organisers (UNIDO Feasibility Studies Branch) and facilities made available during the course were judged by all participating in the training as excellent.

COMFAR TRAINING WORKSHOP

5 - 16 September 1988
UNIDO, Vienna

List of Participants

Name	Institution and Country
Ms. L. Algerin	SWEDFUND, Sweden
Ms. B. Dekrout	MINISTRY OF FOREIGN AFFAIRS, Austria
Mr. M. El Sebai	EXPORT DEV. BANK OF EGYPT, Egypt
Mr. A.A.R. Al Kawaz	THE ARAB PLANNING INSTITUTE, Kuwait
Mr. P.S. Vaklev	MACHINOEXPORT ENGINEERING, Bulgaria
Mr. D. Schietinger	HEILBORN GMBH, F.R.G.

COMFAR TRAINING WORKSHOP

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Programme of the Workshop

Day	Morning	Afternoon
5/IX	Opening ceremony Introduction to Workshop Project Development Cycle	Basics of computer hardware; MS-DOS:functions, general Structure and basic commands
6/IX	MS-DOS: group exercises Financial analysis: balance sheet	Financial analysis: income statement, sources and uses of funds
7/IX	Financial analysis: ratios, discounting techniques	COMFAR:structure of programme's Financial Module
"	COMFAR main system: entry table, calculation and reporting systems; group exercises (manual case)	COMFAR main system: group exercises
9/IX	COMFAR main system: interpretation of results (schedules, input and output tables); sensitivity analysis	COMFAR main system: group exercises (cases high-lighting specific programme features)
12/IX	COMFAR main system's GRAFIX Module (Guest lecturer: Mr. P. Hawranek)	GRAFIX (continued): sensiti-analysis

Day	Morning	Afternoon
13/IX	Economic cost-benefit analysis: general introduction, main approaches	ECBA: transfer items, traded non-trade goods, border prices
14/IX	ECBA: shadow prices (foreign exchange, land, labour, capital); foreign exchange effect; value added approach	COMFAR economic impact: general structure, main routines group exercises (ECBA manual case study)
15/IX	COMFAR economic impact: group exercises (continued)	COMFAR economic impact: interpretation of results; cost-benefit graphics module
16/IX	Practical application of COMFAR: data collection and interpretation of results, sensitivity analysis; Closing Ceremony	COMFAR: individual exercises (programme's special features; application to modernisation and expansion projects

INTRODUCTION

TO

COST-BENEFIT ANALYSIS

Cost-Benefit Analysis in Developing Countries

Projects are the building blocks of plans. In fact, we may define a project as the smallest unit of activity—from a technical or economic point of view—that can be undertaken. Such a unit of activity may be further defined as the coordinated use of scarce resources for the production of goods or services that increase national welfare relative to the situation without the project. There are several aspects to this definition that need elaboration. First, the word coordinated is used to indicate that some kind of organization—a private enterprise, a government department, a state corporation, a joint venture, or some other body—is necessary to operate the project. Second, we speak of a project only if its objective is to produce goods or services that increase national welfare. For instance, building a factory does not in itself constitute a project; since the factory should eventually produce goods or services, the project, in this case, consists not only of the investment in the factory but also of the factory's operations, in the most general sense of the word, during its economic life. Third, the word investment is intentionally not used in the definition so that also such activities as research and extension can be considered projects. Finally, the definition implies that, somehow, national welfare should be maximized.

The theory of cost-benefit analysis provides criteria for the design and implementation of individual projects and for the selection of a series of projects to arrive at a country's development program. The theory borrows substantially from both micro- and macroeconomic analysis in that the project must be considered both as an individual entity and also within the broader perspective of the national economy. An essential element of the theory is that it focuses explicitly upon the objective of increasing national welfare. What then is national welfare?

Often it is believed that national welfare can be maximized by maximizing profits. But if economic costs and benefits differ from financial costs and benefits, then profits cannot be taken to be the right measure for investment decisionmaking from a national point of view. In many cases there may be fundamental differences between a profitability analysis that uses market price data and a cost-benefit analysis that uses imputed values—the real economic values of costs and benefits. We may illustrate the issue with a number of examples.

First, suppose that a crop failure has increased the price of rice. With an inelastic demand curve, revenues and private profits will then be larger than they were before the crop failure. The use of the profit criterion leads thus to the ridiculous conclusion that a misharvest is better than an abundant crop. In reality, of course, the crop failure has reduced national welfare. In cost-benefit analysis this loss is measured by evaluating the loss in welfare of the consumers.

A second deficiency in the use of market prices arises when the factor of production in question is not fully employed. Assume, for instance, that there is unemployment. Then, the cost of hiring an unemployed laborer is obviously not measured by the wage cost, since the cost of employment is much greater than any marginal contribution to the production the laborer may have made in his unemployed situation.

Third, many countries employ systems of exchange control and licensing. In such cases the price of an imported good valued at the official exchange rate may well be a serious underestimate of the scarcity value of the import. The same may also apply in such cases to exports.

Fourth, inflation—a phenomenon almost pervasive in the present-day circumstances—can create serious distortions. Many costs and benefits may have no relation whatsoever to the real scarcity values of costs and benefits.

Fifth, a private profitability analysis pays often no attention to technological externalities, that is, to the effects of the contemplated investment on such things as water or air pollution or the environment in general. In a cost-benefit analysis such harmful effects must be taken into account.

Finally, as a last point it may be mentioned that a profitability analysis from a private point of view cannot capture considerations dealing with the distribution of income between persons and over time. A dollar accruing to a rich man is generally believed to be less valuable socially than a dollar accruing to a poor man. Hence, an increase in national income going to poor income groups would increase welfare more than if the income were to accumulate in the hands of the rich. Similar considerations may apply as regards the distribution of income between generations.

While a profitability analysis, as for instance undertaken by a firm, analyzes costs and benefits from a private point of view on the basis of market prices, the essence of cost-benefit analysis is that the costs and benefits of a program or project are measured on the basis of accounting prices or as they are sometimes called, shadow prices. These prices reflect the real scarcity values of the factor of production and of the

Selection reprinted from F. Leslie C. H. Helmers, "Cost-Benefit Analysis," paper prepared for International Monetary Fund seminar on budgeting and expenditure control, Washington, D C., June 9–20, 1980; processed, pp. 2–11.

goods produced and also the indirect effects the project may have on national welfare.

Cost-benefit analysis should in principle be applicable to all kinds of projects. There are, however, projects whose benefits are difficult to quantify, such as those dealing with population control, health, education, and defense. Cost-benefit analysis has therefore developed mainly in the direction of projects with tangible benefits, such as those concerning agriculture, industry, transport, and other infrastructure projects.

National Planning and Cost-Benefit Analysis

In principle, the theory of cost-benefit analysis considers only those variables that are relevant to the project under consideration. It is possible, therefore, that one could imagine that all these variables should be determined by the project preparation agency. This would be a mistake because several project variables can be determined only at the macro level. For instance, the demand for a product depends inter alia on population and income growth; the supply situation or a project's input mix depend on the growth path of the economy; the shadow price of foreign exchange and the discount rate to be used for project planning are clearly national parameters; and so on. If every project evaluator were to determine individually the national parameters, there would be quite a duplication of effort. Moreover, in all probability, one would end up with divergent estimates and misinvestments because the government departments and public corporations that prepare the various investment projects would not have sufficient information to estimate the national parameters meaningfully. It is the task of the central authority—the Central Planning Unit or the Treasury—to review the projects prepared and proposed by the different departments and corporations and to determine after consultation with them what the final set of projects will be. But it is this final set that determines how the economy will develop, so that only the Center can really determine what the values of the national parameters are. Furthermore, it may so happen that the available investment funds will not be sufficient to undertake all the proposed projects. In such a case, it is the Center's task to set the cut-off rate of return for the individual projects at such a level that the number of acceptable projects will just exhaust the available budget. This rate also can be determined only at the Center.

A national plan consists normally of sectoral plans so that the possibilities within a sector can be reviewed and misinvestments prevented. Suppose, for instance, that every region in a country plans to undertake a sugar project. Some sectoral review is then required to prevent the likely overinvestment. Also, sectoral plans will be necessary when different types of projects within a sector are interconnected. For instance, in the transport sector, a port project may necessitate improvement of road and rail connections with the hinterland, or the improvement of a certain road may necessitate a feeder road improvement program, and so on. Furthermore, it is possible that a shortfall of investments in the transportation sector may hold back development elsewhere in the economy. Clearly, if the sector is so important, some long-term planning is necessary. Another example would be the following. Assume that a large power resource—hydroelectric, gas or oil—can be developed at low cost. Then it may be in the country's interest to set up a long-term plan for the promotion of energy-intensive industries. In general then, sectoral planning will be necessary where overinvestments may occur, where important interrelations within the sector exist, or where the sector will have an important impact on the rest of the economy.

In addition to sectoral planning, plans may be required for regions or income groups. As regards regions, important interconnections may exist between agriculture, industry, transport, labor, etc., which make such plans mandatory. As regards income groups, it is now more and more accepted that for certain groups some form of planning is required. Assume, for instance, that the income level of a certain income group, say, smallholder farmers, is expected to remain depressed. Assume further that the government has decided to remedy the situation by means of an investment program geared toward raising the income level of the group; then also a series of projects spread out over time and interconnected, i.e., a plan, will be necessary.

Since most sectoral plans will have a substantial impact on other sectors and plans for regions or income groups will cover several sectors, the drawing up of the plans should in most cases be done jointly by the Center and the concerned government departments. The Center thus plays a crucial role. It is responsible for the macro-economic plan, it has to assure itself that the intermediate level plans relate properly to the overall plan, and it has to decide which set of individual projects will be implemented. In all of this it needs project data for the calculation of the national parameters but, at the same time, the lower levels can only provide the project data after they have received the national parameters.

Although such interactions might appear to involve an insolvable circularity, the process, if it is appropriately handled, would sharpen the understanding of the central authority as regards the desired development path of the economy. In a well-run administration the interaction might take place as follows. The central authority would make, with the help of programming models, tentative projections of development objectives and national param-

eters, which it would submit to the various government departments. These would use the data in the preparation of projects within their jurisdiction and submit to the Center a list of projects together with feasibility studies. The Center would review how the proposals would fit in with the initial development strategy, calculate new national parameters, including tentative cut-off rates of return in case of a shortage of available funds, and submit them to the departments, which would in turn revise their plans and submit them to the Center, and so on. As a result of these interactions, it can be expected that a well-formulated national plan, including intermediate level plans, and a set of well-prepared projects would emerge.

It must be remarked that the above sketch presents the target toward which the planning process should strive. In many countries we still find that the concerned government departments have no planning unit or that the interaction between the Center and the Department is still so rudimentary that the latter has little notion of the values of the national parameters. It is encouraging to see, however, that all this is gradually changing for the better.

In the past, many governments relied mainly on macro-economic plans for their investment strategies. Often these plans were based on estimates of simple sectoral capital-output ratios and, as a result, serious misinvestments occurred. Take, for instance, the commonly used incremental output to capital ratio $\Delta Y/\Delta K$. The theory underlying the use of this indicator is that investments should be stepped up in those sectors where the ratio has a high value. In other words, investments in a sector where $\Delta Y/\Delta K$ has a value of, say, ⅓, which is taken to mean that an additional dollar invested has a return of 33 percent, is assumed to provide more benefits than investment in a sector where $\Delta Y/\Delta K$ has a value, say, of ⅕, i.e., a 20 percent rate of return. The deficiencies of this approach are clear. First, the benefits will not be produced immediately so that the actual rate of return will be much lower. For instance, if ΔY were to materialize after four years and

if $\Delta Y/\Delta K$ is ⅓, then the rate of return γ would be 16 percent instead of 33 percent. But also this would be an overestimate since projects do not have infinite lives. If one wants to work with a rate of return, then one should draw up the stream of costs and benefits of the investment and calculate the internal rate of return of these streams. Second, the ratio does not reflect accurately the costs that must be incurred to produce the additional benefits. The ratio states that incremental output will be produced by additional investment. Obviously, however, this cannot be correct because output is not only a function of capital, but also of labor. The formula assumes that labor has a zero cost and this is, of course, a very unrealistic assumption.

Our criticism of the output to capital ratios should not be taken to mean that the ratios have no role to play in the drawing up of investment strategies. They do, but the resource allocations emerging from the models, even if more refined ratios are used, are still so crude that the possibility of serious mistakes cannot be excluded. Cost-benefit analysis of individual projects has a crucial role to fulfill in that it can reduce these errors. As it is based on detailed investigations of the economic viabilities of individual projects, it can ensure that only projects with high priority will be selected. Similarly, as regards intermediate level plans, cost-benefit analysis can be very useful. If a certain sector's initial set of projects includes some with low rates of return then it would be in the national interest to transfer part of the initial budget allocation for that sector to a sector where projects have higher rates of return. Cost-benefit analysis thus not only increases the likelihood that the investment program will be successful, it leads also to an optimal program. Fortunately, it is becoming increasingly accepted that the basis on which macro plans as well as intermediate level plans rest are well thought out individual project proposals. Cost-benefit analysis is the tool that provides this basis.

The Derivation of the Shadow Prices

In many economies market prices do not reflect the real scarcity values of the goods and services that are being produced. Monopolies, decreasing cost industries, taxes, externalities, foreign exchange and capital scarcities, unemployment and underemployment, government fixation of prices and wages, inflation, and so on are common in most of the developed as well as the developing countries.

Is it at all possible, in view of the many difficulties, to determine all the relevant shadow prices? It has been suggested that they should be derived from general programming models. Such models can generate Lagrangean multipliers that represent in economic terms the shadow prices, which, given the constraints incorporated in the model, will result in an allocation of resources that will satisfy the postulated objective function. Such models should, in principle, be able to produce the real scarcity prices of the goods and services. However, although the models can provide valuable insights concerning the structural relations that exist in an economy, we seriously question on practical grounds whether all the shadow prices obtained from the models can be used for operational work. First, the models are still highly aggregated so that most of the duals they generate—the shadow prices—are extremely crude. Second, it must seriously be doubted whether the models can

really depict the real world situation. It is not only that there are many distortions but also, to formulate the models, all cost and demand functions should be known. Obviously it is impossible to collect all these data. We feel, therefore, that in addition to the models approach a more practical approach must be followed.

In fact, this approach—the opportunity cost doctrine—has existed for a long time. Consider an economy where only two goods, X and Y, are produced. Then the calculation of the costs of an output expansion would not pose a difficult problem. For instance, if the production of X is to be increased, the cost of producing the additional quantity of X is to be found by measuring the value of the Y goods that the community will have to give up in order to increase the production of X. Analysis of the production and demand functions for goods X and Y should readily provide the required data. The situation is more complicated when a multiplicity of goods is being produced, since it will obviously be impossible to analyze the production functions and demand curves of all the different goods. The opportunity cost doctrine therefore takes as a starting point the inputs which X uses rather than the displaced Y goods and defines the costs of these inputs as the returns that they would earn in the next best alternative elsewhere.

The opportunity cost approach is necessarily a detailed approach. The project analyst must investigate from where the resources for a project will be withdrawn and what their values are in those uses. As long as resources with low valued uses can be transferred to higher valued uses, the change is beneficial. This, in a nutshell, is what the theory of project planning is all about.

Without any claim for comprehensiveness, we may now illustrate how the shadow prices can be found in practice. When a project needs a certain input, then it is likely that to some extent demand elsewhere will be curtailed as well as that some additional quantities will be produced to satisfy the additional demand generated by the project. Thus the opportunity cost of the input consists of the weighted average of the value forgone in the alternative use and the resource cost of the additional production, the weights being the fractions of demand displaced and supply induced to additional demand. What will happen in practice depends on the shape of the demand and cost functions and theoretically the analyst needs therefore to investigate these functions in detail. In real life, however, it often suffices to make some rough estimates as the project may not be sensitive to the value of the input in question.

Foreign exchange is for many countries such a scarce resource that it can be treated as a separate production factor. To determine the shadow price of foreign exchange, we apply the same analysis as for an input. We should thus consider how an additional dollar of foreign exchange can be obtained and then determine the real resource values in the forgone uses. In principle, there are two ways to obtain foreign exchange: curtail imports or increase exports.

In case of a curtailment of imports, the shadow price of foreign exchange can be found by comparing the domestic value of the import with its c.i.f. value converted at the official exchange rate. Hence, if there are no quantitative restrictions, this value will be higher than the official exchange value by the amount of the import duties. Thus if the official exchange rate is US$1.00 = Rs2.00 and the import duties are 30 percent, the domestic value of US$1.00 of foreign exchange is Rs2.60.

If exports are to be increased, then the resources otherwise used to produce homegoods will be used to produce export goods. Hence, the shadow price of foreign exchange consists then of the resource value of the forgone homegoods. If there are no restrictions on exports, the level of the export duties or subsidies will provide us with a good indicator of the domestic value. For instance, if export duties average 10 percent of f.o.b. value of Rs0.20 per US$1 exported, then this means that exports are Rs0.20 more expensive than the homegoods that could be produced with the same resources. Hence, the domestic value of the exports and the shadow price of foreign exchange would then be Rs1.80 = US$1.00.

As in all cases where a resource is used, there are thus two shadow prices corresponding to whether the resource comes from a displaced use or is additionally produced. As in reality there will be some combination of the two possibilities, the correct shadow price will be a weighted average of the two shadow prices. Now, with respect to foreign exchange it is, of course, extremely difficult to determine by how much exports will be increased and imports reduced if additional foreign exchange is needed. A shortcut method is to work with a normal average of the two shadow prices and, in our example, this would be the average of 2.60 and 1.80, so that the base estimate can be set at Rs2.20. Further refinements can be made by considering whether one or the other possibility of earning foreign exchange is the more likely. For instance, if in our country import curtailment is easier than increasing exports, then the foreign exchange shadow rate can be estimated at somewhere between Rs2.20 and Rs2.60. On the other hand, if it is easier to increase exports, then the shadow rate could be set at somewhere between Rs1.80 and Rs2.20. Whatever value one chooses, in all cases sensitivity tests should be applied.

As regards the shadow price of labor, many developing countries have still a shortage of skilled labor so that market wages can often be taken to represent the real scarcity values of this production factor. In several developing countries, however, un-

skilled labor is available in abundant supply. The determination of its shadow price is distinct from all other production factors because of the fact that the laborer's services are tied to the laborer. This means that, if a laborer is withdrawn from existing employment to work in a new job, then not only the forgone product of the laborer but also the disutility of his extra effort should be taken into account to determine the shadow price. Thus, even if the forgone product of a hired unskilled worker is negligible, the shadow price must be set at the price which will induce him to work in the new job.

In many cities in the developing countries, we see that the influx of rural workers is greater than the job openings in the formal well-paid sector. In such cases, more than one person migrates to the cities when one person is hired. What this means is that in order to find the shadow price of labor, we must add to the opportunity cost of the hired laborer the opportunity cost of the workers who have migrated, but who cannot find a job in the formal sector. The shadow price of labor in the cities may thus be a multiple of the rural shadow price of labor. It is, of course, very difficult to determine precisely what the exact migration function is, as often no reliable data will be available. The best one can do in such cases is to assume that the shadow price of urban labor lies somewhere between the institutional and the rural wage rate adjusted for cost-of-living differences. The use of both values will show whether the project is sensitive to the shadow wage rate and in cases where the shadow rate appears to be important, a range of rates of return can then be calculated to help the decisionmaking process.

Finally, a few remarks about the shadow price of capital. As a general principle, the rate of return of the project should be higher than the rate of return which the capital resources would have in their next best alternative.

Let us assume that the resources consist of displaced investment. Then there is the problem that the earnings of many enterprises are subject to corporation taxes and that some of these earnings include rewards for risk taking. Furthermore, the dividends and interest payments accruing to the investors will often be subject to income taxes. Should the shadow price of capital be calculated gross or net of such taxes and risk premiums? From the point of view of society as a whole, it is the forgone yield that is relevant. Hence, the correct shadow price should be the rate of return gross of taxes and risk premiums. That different parts of that rate of return accrue to the government is not important since these are mere transfer payments. But what if part or all of the capital resources for the proposed project come from displaced consumption rather than displaced investment? If the income distribution in the country is not optimal, then there may indeed be a case to evaluate this consumption component differently from the displaced investment component, and more about this will be said later on. In case, however, the income distribution is considered roughly optimal, consumption may be considered as valuable as investment, and the shadow price of capital consists then of the weighted average rate of return on capital in the economy. In this respect it is perhaps of interest to mention that Harberger, after detailed investigation, arrived at rates of return on capital in India ranging from 17.2 to 21.3 percent. Lal made a similar investigation of the opportunity cost of capital in India and found rates of return ranging from 12 to 19 percent. It needs no elaboration that in a country with an abundance of capital resources, such as Saudi Arabia, the shadow price of capital will be much lower.

The Calculation Techniques

After having imputed the correct scarcity values to all the inputs and outputs of a project, including negative values for harmful effects on the environment, the task at hand is to determine whether the project is worth undertaking. Two criteria have become common: the net present value and the internal rate of return criterion.

Under the net present value criterion all the costs and benefits of the project are discounted at the opportunity cost of capital to present values, and the project is considered worthwhile if it has a positive net present value. The criterion amounts thus to the calculation of the present value of the surplus the project generates over and above the opportunity cost of capital.

The internal rate of return criterion consists of calculating by trial and error the discount rate at which a project has a net present value of zero—the project's internal rate of return—and accepting the project only if its internal rate of return is larger than the opportunity cost of capital.

Is the internal rate of return criterion a theoretically correct criterion? The answer is negative and the criterion may lead to wrong results if projects are to be ranked by priority. The reason for this is that the internal rate of return criterion assumes incorrectly that the benefits of the project under scrutiny will be reinvested at the internal rate of return instead of at the opportunity cost of capital as assumed under the net present value criterion. It is intuitively clear that the two criteria will therefore result in a different ranking of projects. If budgetary constraints play a role, so that a choice must be made out of a series of projects, then the only correct criterion is the net present value criterion. The way to proceed then is to calculate for each project the present value of the surplus it generates per dollar of current investments,

and to choose those projects that have the highest surplus ratios.

The problem with the net present value criterion is, however, that the opportunity cost of capital, which serves as the discount rate, is difficult to estimate. One may attempt to calculate net present values by using a minimum and a maximum value for the opportunity cost of capital, but where one can only estimate that the opportunity cost of capital lies between some very extreme values, this procedure is not very meaningful. In such a case, the internal rate of return method may be used to establish a tentative ranking order of projects. As projects with high internal rates of return will be accepted in any case, one can then spend extra time on projects with low rates of return—those at the margin of acceptability—in order to sharpen the accept-reject decision. This may be done for instance by calculating probability distributions of the costs and benefits. We feel, therefore, that the internal rate of return is an important tool in practical work despite its theoretical limitations.

C O M F A R

I N P U T

T A B L E S

1. TEXT VARIABLES

---------- COMFAR - DATEN ----

1	Project name:	
2	Date and time:	
3	Remarks:	
4	Accounting units and currency:	

5 Product name(s) ---------- sub-menu

Product A:	
Product B:	
Product C:	
Product D:	
Product E:	
Product F:	

2. GENERAL VARIABLES

1 Foreign currency conversion rate: [ ]

2 Local currency conversion rate: [ ]

3 Duration of construction (in years): 1/2/3/4/5/6/7/8
(maximum four years if half-yearly,
otherwise maximum eight years)

4 Planning during construction: yearly/half-yearly

5 Cashflow discounting rate (in per cent)

---------- sub-menu

1 Discounting rate for net present value: [ ]

6 Equity and subsidy conditions

---------- sub-menu

year disbursement starts

1 Foreign equity - o(rdinary): [ ]

2 Foreign equity - p(referred): [ ]

3 Foreign subsidy: [ ]

4 Local equity - o(rdinary): [ ]

5 Local equity - p(referred): [ ]

6 Local subsidy: [ ]

7 Loan and overdraft conditions

---------- sub-menu

foreign loan A

1 Year disbursement starts: [ ]

2 Amortization type: constant principal/annuity/profile

3 Amortization period (in years): [ ]

4 Amortization paid: yearly/half-yearly/quarterly

5 Grace period (in years): [ ]

6 Interest rate (in per cent per year):

[ ] from year [ ] through [ ]
[ ] from year [ ] through [ ]
[ ] from year [ ] through [ ]

---------- sub-menu

foreign overdraft

1 Year disbursement starts: [ ]

6 Interest rate (in per cent per year):

[ ] from year [ ] through [ ]

3.1 I N I T I A L F I X E D I N V E S T M E N T - (f)oreign/(l)ocal *) *) mark item(s) applicable

Columns		1	2	3	4	5	6	7	8	9	10	11	12
Lines f/l *)	Description of investment	Depreciation % p. a.	Depreciation type	Sal. v. %	Depr.p. years	Construction phase → per. 1	per. 2	per. 3	Planning period = year/half-year *) per. 4	per. 5	per. 6	per. 7	per. 8
1/13	Land												
2/14	Site preparation and development												
3/15	Structures and civil engineering (a)												
4/16	Structures and civil engineering (b)												
5/17	Inc. fix. assets (a) constr., transport												
6/18	Inc. fix. assets (b) technology, start-up												
7/19	Inc. fix. assets (c) others												
8/20	Plant, machinery and equipment (a)												
9/21	Plant, machinery and eqipment (b)												
10/22	Auxiliary & service facilities												
11/23	Pre-production expenditures												
12/24	Inventory												

3.2 C U R R E N T F I X E D I N V E S T M E N T - (f)oreign/(l)ocal *)

Lines f/l *)	Columns / Description of investment	1 Depreciation % p. a.	2 Depreciation type	3 Res. v. %	4 Depr.p. years	5 Production phase year 1	6 year 2	7 year 3	8 year 4	9 year 5	10 year 6
25/37	Land										
26/38	Site preparation and development										
27/39	Structures and civil engineering (a)										
28/40	Structures and civil engineering (b)										
29/41	Inc. fix. assets (a) constr., transport										
30/42	Inc. fix. assets (b) technology, start-up										
31/43	Inc. fix. assets (c) others										
32/44	Plant, machinery and equipment (a)										
33/45	Plant, machinery and equipment (b)										
34/46	Auxiliary & service facilities										
35/47	Pre-production expenditures										
36/48	Inventory										

*) mark item(s) applicable

3.3.1 A N N U A L P R O D U C T I O N C O S T S - (f)oreign/(l)ocal *)

Lines f/l *)	Columns / Description of cost and cost adjustment item	1 Inflat. % p. a.	2 Production phase year 1	3 year 2	4 year 3	5 year 4	6 year 5	7 year 6	8 year 7
52/82	Raw material (a)								
53/83	Raw material (b)								
54/84	Utilities								
55/85	Energy								
56/86	Labour, direct								
57/87	Maintenance, repairs								
58/88	Spare parts								
59/89	Factory overheads								
60/90	Administration, labour costs								
61/91	Administration, non-labour								
62/92	Marketing, labour								
63/93	Marketing, non-labour								

*) mark item(s) applicable

3.3.2 S T A N D A R D P R O D U C T I O N C O S T S - (f)oreign/(l)ocal *)

Lines f/l *)	Columns / Description of production costs item	1	2	3	4	5	6	7	8	9	10	11	12
		Product A		Product B		Product C		Product D		Product E		Product F	
		value/a	vari. %	value/a	vari. %	value/a	vari. %	value/a	vari. %	value/a	vari. %	value/a	vari. %
64/94	Raw material (a) 1)												
65/95	unit cost 2)												
66/96	Raw material (b) 1)												
67/97	unit cost 2)												
68/98	Utilities p.a.												
69/99	Energy p.a.												
70/100	Labour, direct p.a.												
71/101	Maint. & repairs p.a.												
72/102	Spare parts p.a.												
73/103	Factory overhead p.a.												
74/104	Admin. labour p.a.												
75/105	non-lab. p.a.												
76/106	Marketing labour p.a.												
77/107	non-lab. p.a.												
78/---	total deprec. borne %												

1) enter either quantity (units consumed p. a.) or annual costs
2) enter "1" if annual costs are entered instead of quantity

*) mark item(s) applicable

3.4. PRODUCTION AND SALES - (f)oreign/(l)ocal *)

Lines f/l *)	Description	1 Inflat. % p. a.	2 Production phase year 1	3 year 2	4 year 3	5 year 4	6 year 5	7 year 6	8 year 7
	PRODUCT A								
110/--- ---/146	Quantity produced/sold								
111/147	Sales price per unit								
112/148	Total sales tax								
113/149	Total other direct sales costs								
114/150	Total other dir. non-var. costs								
115/151	Labour costs includ. in 114/150								
	PRODUCT B								
116/--- ---/152	Quantity produced/sold								
117/153	Sales price per unit								
118/154	Total sales tax								
119/155	Total other direct sales costs								
120/156	Total other dir. non-var. costs								
121/157	Labour costs includ. in 120/156								

*) mark item(s) applicable

3.5 WORKING CAPITAL REQUIREMENTS

Lines	Columns / Description of assets / liabilities	1	2	3	4
		Minimum coverage (in days)			
		Products/costs		Cash in hand	
		foreign	local	foreign	local
	ASSETS				
	Accounts receivable/ /cash in hand:				
	INVENTORIES				
183	Raw material (a):				
184	Raw material (b):				
185	Utilities:				
186	Energy:				
187	Spare parts:				
188	Work in progress:				
189	Finished products:				
	LIABILITIES				
190	Accounts payable:				

3.6 SOURCES OF FINANCE - (f)oreign/(l)ocal *)

Lines f/l *)	Columns / Description	1 per. 1	2 per. 2	3 per. 3	4 per. 4	5 per. 5	6 per. 6	7 per. 7	8 per. 8	9 per. 9	10 per. 10
		Financial flow of funds (disbursements) by period									
	EQUITY, SUBSIDIES AND GRANTS										
191/198	ordinary shares										
192/199	preference shares										
193/200	subsidies & grants										
	LOANS AND OVERDRAFTS										
194/201	loan A										
195/202	loan B										
196/203	loan C										
197/204	flow funds drg. const., overdrafts										

*) mark item(s) applicable

3.7 INCOME, TAX AND CASHFLOW

Lines	Columns / Description	1 Income tax 0=constant 1=variable	2 Constant tax rate in % p. a.	3 Tax holi-days in years	4 Period to c/f loss, in years	5 Period of tax cred. in years	6 Additional tax on profit distributed foreign	7 (in %) local
205	Income tax descriptors							

Lines	Columns / Description	1	2	3	4	5	6	7	8
		Annual payments Production phase →							
		year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8
206	Investment allowance								
207	Depreciation allowance								
208	Income tax adjustment								
209	Variable tax rate (%)								
	PROFIT DISTRIBUTED ON:								
210	preferred equity, foreign								
211	preferred equity, local								
212	ordinary equity, foreign								
213	ordinary equity, local								

ECONOMIC ANALYSIS

VALUE ADDED APPROACH

From:

MANUAL FOR EVALUATION OF
INDUSTRIAL PROJECTS

UNIDO, 1980

Basic criterion of national profitability—value added

Value added, as stated earlier, is the basic criterion for the overall effects of a project on the economy. It represents in a most general way the difference between the output value and the value of inputs purchased from other units.

The evaluation of an investment project is based on net value added. Net value added generated by a project equals value of output, minus value of current material inputs and services purchased from outside the project, minus total investment outlays:

$$\text{NVA} = O - (\text{MI} + I) \tag{10}$$

where

NVA = expected net value added generated by a project;

O = expected value of the output of a project which is usually the sales revenue;

MI = expected value of current material inputs and services purchased from outside the project required to obtain the above output;

I = total investment.

It may be noted that the material inputs of a project include all current materials and services (raw materials, energy, fuel, transport, maintenance etc.) purchased from outside the project.

The net value added comprises two major components: wages and salaries, W, and social surplus, SS:

$$\text{NVA} = W + \text{SS} \tag{11}$$

Wages and salaries express the level of employment and the average wages of the people employed. The social surplus expresses the earning capacity of a project. It comprises indirect taxes, interest, dividends, insurance and reinsurance charges, rent, royalties, and undistributed profit that is being used by the firm for expansion funds, reserve funds, social welfare funds etc.

Net value added can be measured for any single year or for the entire life of the project.

Net value added for a single year:

$$\text{NVA} = O - (\text{MI} + D) \text{ (for that year)} \tag{12}$$

where

D = annual depreciation.

Net value added for a project's whole economic life:

$$\sum_{t=0}^{n} \text{NVA} = \sum_{t=0}^{n} O_t - \sum_{t=0}^{n} (\text{MI} + I)_t \tag{13}$$

or (which is the same):

$$\sum_{t=0}^{n} \text{NVA} = \text{NVA}_0 + \text{NVA}_1 + \ldots + \text{NVA}_n \tag{14}$$

where

$\sum_{t=0}^{n} \text{NVA}$ = net value added generated by a project throughout its economic life from year 0 to year n;

$\sum_{t=0}^{n} O_t$ = expected value of output throughout the project's life from year 0 to year n;

$\sum_{t=0}^{n} (\text{MI} + I)_t$ = expected current material inputs MI and investments I throughout the project's life from year 0 to year n;

$\text{NVA}_0, \text{NVA}_1, \ldots \text{NVA}_n$ = expected annual net values added throughout the project's life from year 0 to year n.

As may easily be seen, formulae 13 and 14 provide a more explicit presentation of formula 10, emphasizing the need to take into consideration all benefits and costs throughout the economic life of a project.

The net domestic value added produced by a project consists of two parts:

(a) Net national value added: that part that is produced and distributed in a country;

(b) Repatriated net value added: that part that is produced by a project but repatriated abroad (wages, interest, net profits, dividends, rents, royalties, insurance and reinsurance, or any other foreign payments not included in material inputs).

Investment projects are evaluated in terms of net national value added (NNVA). This value added is the most important index of the contribution of a project to the national economy. All repatriation payments are to be excluded. The formula for finding the net national value added would therefore be as follows:

$$\sum_{t=0}^{n} \text{NNVA} = \sum_{t=0}^{n} O - \sum_{t=0}^{n} (\text{MI} + I + \text{RP}) \qquad (15)$$

where RP is equal to all repatriated payments in respect of this project such as royalties, insurance, rents, interest and net profits of foreign capital as well as wages of expatriate labour.

Any further mention of value added in this Manual refers to net national value added unless otherwise stated. For the sake of brevity, only value added will be used.

The total value added generated by an investment project comprises:

(a) Direct value added: that produced within a project itself;

(b) Indirect value added: additional value added generated by other projects technologically and economically related to a project under consideration. This induced value added would not have been produced if the project in question had not been established.

The evaluation of an investment project should in principle be based on the total value added, both direct and indirect. The procedure for measuring the indirect value added is provided in the section on measuring the indirect effects. If it is too difficult to measure the indirect value added or if its magnitude is negligible and therefore not worth the effort, all calculations of efficiency may be based on direct value added only.

Application of the value added criterion for evaluation of new investment projects

Two stages are suggested for the application of the value added criterion: *absolute efficiency test* for screening purposes and *relative efficiency test* for ranking purposes.

3.1.1 Absolute efficiency test

(a) *Simple formula.* For small projects with a uniform stream of value added as well as for larger projects at the early stages of project formulation, it is advisable to compile the value added for a normal year manifesting the normal operational conditions of the project. The normal year should be the same as that selected for commercial profitability analysis. This estimate will provide only a preliminary idea of the benefits of a project to the country. If the result shows positive value added, it is a good sign for proceeding further with the project. On the other hand, if the result is negative, it sounds an early warning and careful thought has to be given before continuing with the project, with particular emphasis being given to those aspects of the economy in the context of which the project is being initiated.

At the same time it might be useful to discern whether the value added estimated for a single year also yields some surplus over the wages for that year. This can be assessed by use of the following formula:

$$E_s = O - (\mathrm{MI} + D) > W \qquad (16)$$

where

- E_s = absolute efficiency test of the project in terms of value added surplus over the wages on the basis of data for a normal year;
- O = expected value of normal annual output (usually annual sales revenue);
- MI = expected value of normal annual current material inputs and services purchased from outside the project;
- D = expected depreciation of fixed capital in a normal year;
- W = expected wages in a normal year.

As can be easily seen, the proposed simple formula is based on net domestic value added. This is recommended since at the early stage there may not be sufficient information regarding repatriated payments. If the project evaluator possesses this information and the repatriations are expected to be of crucial importance, they could easily be introduced in formula 16. If the project being formulated shows such a social surplus, it passes the absolute efficiency test at the early stages of formulation, indicating that it will yield a surplus after meeting its wage obligations.

A more detailed analysis of the project may now be undertaken with some confidence. Even if there is no such surplus, it may not be necessary to abandon the project at this stage, but how to improve it may be considered.

The application of the simple formula for an absolute efficiency test is illustrated by an example of the same hypothetical project considered in the section on commercial profitability (II.A.). Its data are derived from table 9 and compiled in table 16.

TABLE 9. INTEGRATED VALUE ADDED ANALYSIS[a]

(Thousand dinars)

Item	Year										
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8-t_9	t_{11}-t_{19}	t_{20}
1. *Value of output* (table 4, row 4)	–	–	70	100	100	100	100	100	100	100	120
1.1 Exports (table 4, row 1)			5	10	20	20	25	30	30	30	30
1.2 Domestically marketed (import substitution) (table 4, row 1)			60	80	70	70	65	60	60	60	60
1.3 Domestically marketed (table 4, row 1)											
1.4 Infrastructural services (table 4, row 1)			5	10	10	10	10	10	10	10	10
1.5 Residual value (table 4, row 3)											20
1.6 Others (income from subsidiary activities)											
2. *Value of material inputs*	100	100	30	51	51	51	51	51	51	51	51
2.1 Investments (table 1, row 6)	100	100									
2.1.1 Imported (table 1, row 6)	75	85									
2.1.2 Domestically procured (table 1, row 6)	25	15									
2.2 Current material inputs (table 5, rows 1.1, 2.1, 3.1)			30	51	51	51	51	51	51	51	51
2.2.1 Imported (table 5, rows 1.1.1, 2.1.1)			8	12	12	12	12	12	12	12	12
2.2.2 Domestically procured (table 5, rows 1.1.2, 2.1.2, 3.1)			20	36	36	36	36	36	36	36	36
2.2.3 Infrastructural services (table 5, row 1.3)			2	3	3	3	3	3	3	3	3
3. *Net domestic value added* (1–2)	(100)	(100)	40	49	49	49	49	49	49	49	69
4. *Repatriated payments*			15	16	16	16	15	15	14	10	16
4.1 Wages (table 3, footnote)			3	3	3	3	2	2	1		
4.2 Profits (dividends) (table 7, row 2.2)			12	8	8	8	8	8	8	10	16
4.3 Interest (table 7, row 1.2.2)				5	5	5	5	5	5		
4.4 Others (royalties, insurance and reinsurance etc.) (table 7, row 3)											
5. *Net national value added* (3–4)	(100)	(100)	25	33	33	33	34	34	35	39	53
5.1 Wages (table 3, row 5 minus repatriated wages)			7	9	9	9	10	10	11	12	12
5.2 Social surplus (5–5.1)			18	24	24	24	24	24	24	27	41

[a]The figures in this table are taken from a hypothetical project used throughout the Manual for illustrative purposes. Tables 1-7 are designed to contain all the data necessary for the completion of table 9. References are made against each item of this table indicating the source of the figures from among tables 1-7. All items are expressed in actual market prices for inputs and outputs and in the official rate of foreign exchange.

TABLE 16. ABSOLUTE EFFICIENCY TEST–SIMPLE FORMULA[a]

(Thousand dinars)

Item	*Amount*
1. Expected value of output in a normal year, O (table 9, row 1)	100
2. Expected value of current material inputs in a normal year, MI	51
3. Expected depreciation of fixed capital in a normal year, D	10
4. Expected wages in a normal year, W (table 9, rows 4.1 and 5.1)	12

[a] In accord with the approach under commercial profitability, year 5 is selected as a normal year.

[b] As this is the only case in which depreciation is used in national profitability analysis in the Manual, it is not provided in table 9.

The absolute efficiency test on the basis of a normal year's data shows that:

$$E_s = 100 - (51 + 10) > 12$$

$$E_s = 39 > 12$$

The project generates in a normal year a social surplus of 27,000 dinars over and above wages and therefore passes the preliminary absolute efficiency test.

(b) *Discounting formula.* The application of this formula is recommended for later stages of project formulation as well as when the stream of the annual values added is not uniform. The evaluation of the total effects of the project during its lifetime on the national economy is done with the help of the SRD. The expected annual values added throughout the project's life are all reduced to one figure by application of the SRD, taking into account the different years of their occurrence.

Relative efficiency test

If several competing projects pass the absolute efficiency test, the project evaluator is faced with the problem of ranking. Ranking cannot be done on the basis of the absolute amount of the value added generated since there are usually limitations with regard to production resources which have to be taken into account.

The ranking of investment projects is possible by applying the relative efficiency test to the analysis of the value added accomplished earlier. For this purpose several decision situations may be identified:

(a) In a case in which there are fewer projects and no production resource constraints, all projects that satisfy the absolute efficiency test can be taken;

(b) If there is no clearly pronounced scarce factor or there are several constraints (all important production factors are scarce), the ranking of alternative projects designed to produce the same products should be done by using the absolute efficiency formula. The higher the value added and the surplus of value added over wages, the more useful the project is to the economy;

(c) There are, however, some well-known scarcities of basic economic resources which the developing countries generally face, such as scarcity of capital, foreign exchange and skilled labour. The occurrence of one scarcity or another, among other things, is closely related to the strategy of socio-economic development and the priorities set up. It may therefore be useful to establish which scarcity would vitally affect the setting up and operation of a project and the economy as a whole. Ranking should be done then by relating the value added produced by the project to *the scarcest factor* in the country. Project ranking under three scarce situations relevant for many countries is illustrated below.

Project ranking in a situation of capital scarcity. The objective is to find which projects generate the maximum value added *per unit of capital* invested. This can be assessed by dividing the discounted value added $P(VA)$, by the present value of total investment, $P(I)$, both compiled earlier for finding the absolute efficiency of the project:

$$E_C = \frac{P(VA)}{P(I)} \tag{22}$$

The larger the ratio, the more beneficial the project is from the capital point of view; it could therefore be selected in a situation of capital scarcity. In the hypothetical example the discounted value added is 202,300 dinars and the discounted total investment is 238,000 dinars:

$$E_C = \frac{202{,}300}{238{,}000} = 0.85$$

Therefore, a dinar of discounted investment generates 0.85 dinars of value added. This coefficient seems to be very high, but it has a real meaning only when compared with the same coefficients for alternative projects. The higher the ratio, the better the project.

Project ranking in a situation of foreign-exchange scarcity. The position here is similar to that of capital scarcity, and the object is to find which project produces

the maximum value added *per unit of net foreign-exchange cost.* It is obtained by applying the formula

$$E_{FE} = \frac{P(VA)}{P(FE)} \tag{23}$$

P(FE) will be the present value of the net foreign-exchange cost of a project compiled in table 28 of section II.B.4.3., "net foreign-exchange effect". The net foreign-exchange cost is obtained as the difference between foreign-exchange spending and foreign-exchange earnings (savings) during the lifetime of a project. This formula is applicable only when the foreign-exchange spending exceeds the foreign-exchange earnings of a project. The higher the ratio, the larger is the contribution of value added to the economy per unit of net foreign-exchange cost.

The formula does not apply to the hypothetical project because its foreign-exchange earnings and savings exceed the foreign-exchange spending.

Project ranking in conditions of the scarcity of skilled labour. In conditions of scarcity of skilled labour, it is necessary to find the projects generating a maximum value added *per unit cost of skilled labour.* This can be easily determined as follows:

$$E_L = \frac{P(VA)}{P(L_s)} \tag{24}$$

$P(L_s)$ is the present value of all wages, salaries and fringe benefits given to the local and foreign skilled employees, including the portion repatriated abroad. This figure is readily available in table 3, "Manpower requirements". When both skilled and unskilled labour are scarce, the total wage bill along with the fringe benefits should be used in the denominator of the above formula.

The larger the ratio, the greater is the contribution of value added per unit cost of skilled labour; therefore the project is preferable in a situation in which labour is scarce.

The discounted amount of the wages, salaries and fringe benefits of the local and foreign skilled labour in the hypothetical project was computed as 50,000 dinars. It follows that

$$E_L = \frac{202{,}300}{50{,}000} = 4.05$$

Thus, a dinar of discounted wages, salaries and fringe benefits paid to the skilled labour helps to generate 4.05 dinars of value added. This coefficient should also be compared with respective coefficients for alternative projects. The higher the coefficient, the better the project is.

The application of the relative efficiency tests may necessitate certain technical and economic modifications in the project's design. If the foreign exchange is too scarce, the designers may be asked to modify the project by looking for domestic material substitutes, alternative lower-priced imports, increasing exports etc. This may lead to a certain relief in a situation of foreign-exchange scarcity. The same may apply to the scarcity of capital and of skilled labour.

Distribution effect

The execution of industrial projects can affect the distribution of value added in two ways. Firstly, it can be distributed differently among the social groups, in which case a group distribution effect is relevant. Secondly, the value added may be allocated differently among the regions of a country—the regional distribution effect.

It may be pointed out that distribution objectives could be achieved mainly through the fiscal and price policies of a Government. For instance, different taxes and prices levied and charged to different social groups and regions are usually used to reach a socially desirable distribution effect or at least to soften social inequalities. In addition, however, it may be of interest to find out how the benefits of an investment project are being distributed among social groups and regions, and whether this distribution pattern is in line with the Government's distribution policy. If not, certain modifications may be made in the expected distribution of the benefits to make it consistent with the objectives and priorities of the Government.

The procedure of estimating the distribution effect of a project may be carried out in the following steps:

Step 1: Identify the target social groups or regions. Identification of social groups affected by distribution of the project's value added depends on the purpose of assessing the distribution effect. If the development objective is to achieve equality of distribution for social reasons, two social groups may be identified: low-income and high-income groups. The latter group may be broken down further. The line between the two groups should be determined according to the conditions of a country, but usually it cannot reflect too precisely the differences in welfare because of possible fringe benefits. If no other means of identification is possible, unskilled labour may be taken as representative of the low-income group.

An analysis is very important of the distribution of the value added among the different production agents—wage earners, profit earners and the Government. The pattern of distribution of the value added is not only of economic but also of great social significance. It is economically significant because two projects with the same value added will be appraised differently in accordance with the share of wages, on the one hand, and the social surplus on the other. It is socially significant because the same amount of value added could be distributed in different proportions among wage earners, profit earners and the state treasury, with different social and economic implications. Because of the difficulties that Governments in developing countries often face in establishing an efficient tax system to generate revenue, income in the hands of the Government may be more desirable than income in the hands of the profit earners.

Similarly, the regions within a country may be divided into less developed and more developed, according to a criterion of *per capita* income level, the achieved level of development of infrastructure or of industry. If the development of a politically sensitive frontier or other area is a government objective, it should also be treated as a less developed region irrespective of its *per capita* income level or other criteria.

If income distribution among rich and poor within a region is of concern, this could be analysed by breaking down each income group into regional subdivisions or the region concerned into income subdivisions.

The analysis of the distribution effects of an investment project in a developing country has another very important aspect, namely the distribution of the expected net domestic value added between net national value added and repatriations. Net national value added is a crucial aspect of the distribution of the benefits generated by an investment project. It is important to find out how much of the value added remains in a country and will be used within its boundaries for its benefit and how much will be repatriated abroad.

Step 2: Determine net distribution benefit flows to a social group or region. The *net distribution benefits* are by definition equal to the difference between the social benefits and social costs brought about by a project. The benefits of a group or region are the benefits received minus any payments made to other groups or regions. The distribution costs are defined as costs caused by a project to a group or region minus any compensating benefits received from another group or region. Thus the analysis records the changes in the gains and losses of different social groups or regions.

The net distribution benefits or gains of a group or region may be identified with the value added of a project above the level the group or region received prior to the establishment of this project. Any fringe benefits, if existing, should increase this gain. In case of low-income groups and wage-earner groups, the gain would probably amount to their wages and salaries, while for profit earners and the Government, it would be represented by net profits, interest, insurance, rent and indirect taxes. It should be pointed out that in case of previously unemployed labour, the total wage bill is considered as a gain; otherwise only the difference between the previous wages and the wages paid by the project is accounted for.

The net distribution benefits accruing to a region may include additional wages and salaries, profits, interest and fringe benefits for workers. If the project causes no reduction in the labour force engaged elsewhere in the region, the total wage bill should be considered as a regional net distribution benefit, since the vacant jobs are taken by immigrants from other regions. In case the project reduces the number of workers employed elsewhere in the region, only the net increase of wages should be accounted for. Often foreign (normally only skilled) labour is employed by a new project, and only the part of wages and salaries spent in the region concerned should be included in the net distribution benefits. A similar case may arise with profits and interest, part of which may leave the region. Fringe benefits usually take the form of welfare facilities, such as housing, education, health or recreation institutions.

The net distribution benefits to a social group or to a region should be identified and computed in expected actual market prices for a normal year of the project's life.

As pointed out earlier, the project analysis suggested by this Manual is based on net national value added, i.e. all repatriations abroad are excluded. This applies to the analysis of the distribution effect, too. The benefits obtained by wage earners do not include the repatriated portion of the wages of expatriate labour. The benefits captured by profit earners exclude the repatriated portion of profits, interest and rent on foreign capital.

Table 24 presents a framework for tracing the net distribution benefits in the case of a social group distribution effect.

The items in table 24 could easily be broken down into low-income and high-income groups to get another aspect of the social group distribution effect.

In case one wants to trace the regional distribution effect, table 25 is a suggested format which may be used to supply the necessary data. It should be pointed out, however, that the items in table 25 represent only a model breakdown of net distribution benefits. Other breakdowns may be used as well, depending on the circumstances.

Table 26 provides a framework for analysis of the distribution of net domestic value added between net national value added (to be used within a country) and repatriations abroad (to be used in foreign countries).

TABLE 24. NET DISTRIBUTION BENEFITS FOR SOCIAL GROUPS

(Thousand dinars)

Item	*Normal year*[a]
1. Gross domestic value added (table 9, row 3)	49
Annual depreciation	10
2. Net domestic value added	39
Repatriated payments (table 9, row 4)	16
3. Net national value added	23[b]
4. Wage earners (VA^w)	10
4.1 Wages (table 18, row 5.1)[c]	9
4.2 Fringe benefits (computed, table 9, row 1.7)	1
5. Domestic profit earners (VA^p)	3
5.1 Net profits–dividends to domestic shareholders (table 8, row 7.3)	2
5.2 Interest on domestic private capital (table 8, row 7.2)	–
5.3 Rent received by domestic private owners (computed)	1
5.4 Fringe benefits (computed)	–
6. Government (VA^g)	7
6.1 Taxes paid to the treasury (table 8, row 4.1)	5
6.2 Interest on loans from public banks (table 8, row 7.2)	–
6.3 Profits–dividends to state-owned shares (table 8, row 7.3)	2
6.4 Rent and insurance charges received by the state (computed)	–
7. Undistributed (VA^u)	3

[a] Year 5 was selected as a normal year.

[b] In case of normal year annual depreciation must be deducted.

[c] Excluding repatriated wages.

TABLE 25. NET DISTRIBUTION BENEFITS FOR A REGION OF A COUNTRY

(Thousand dinars)

Item	*Normal year*[a]
1. Wages to workers from the region	8
2. Profits (dividends) to local entrepreneurs	1
3. Interest paid to local banks (local branches of central banks are not accounted for)	–
4. Taxes paid to local Government	1
5. Welfare gains to the region (hospitals, schools etc.)[b]	2
6. Total regional benefits (VA^r)	12

[a] Year 5 was selected as a normal year.

[b] Provided that they are already incorporated in the calculation of NVA.

Step 3: Compute the distribution index. The amount of the net distribution benefits accruing to a social group or region (VA^w, VA^p, VA^g, VA^r) must now be related to the total net national value added created by a project in a normal year. The distribution index of the wage earners may be determined as

$$DB^w = \frac{VA^w}{VA} \qquad (42)$$

TABLE 26. DISTRIBUTION OF THE NET DOMESTIC VALUE ADDED

(Thousand dinars)

Item	*Normal year*[a]		
	Used in a country	*Repatriated*	*Total*
1. Wages (table 9, rows 4.1 and 5.1)	9	3	12
2. Interest on loans (table 8, row 7.2; table 9, row 4.3)	–	5	5
3. Dividends (table 8, row 7.3; table 9, row 4.3)	4	8	12
4. Taxes on profit (table 8, sub-row 4.1)	5	–	5
5. Rent and insurance (table 24, rows 2.3 and 3.4)	1	–	1
6. Fringe benefits (table 24, rows 1.2 and 2.4)	1	–	1
7. Undistributed profit (table 24, row 4)	3	–	3
Total	23[b]	16[c]	39

[a] Year 5 was selected as a normal year.

[b] The figure 23 equals net national value added (table 24, row 3).

[c] The figure 16 equals repatriated payments (table 9, row 4).

where

DB^w = the distribution index of the wage earners (the share of the wage earners in the distribution of the value added);

VA^w = the expected nominal value of wages and fringe benefits paid out by a project in a normal year;

VA = the expected nominal value added created by a project in the same normal year.

If the distribution index of profit earners, the Government or the region is to be determined, the nominator in the above expression would contain VA^p, VA^g and VA^r, respectively.

Therefore, the distribution index shows how much of a project's value added is distributed to wage earners, profit earners and the Government, or generally to the social group under consideration. The sum total of the distribution shares of wage earners, profit earners and the Government as well as the share of the undistributed value added should equal one.

The regional distribution index shows how much of the value added generated by a project is distributed to the region. The sum total of the distribution shares of the regions concerned should also equal one.

Table 24 provides the necessary data for computation of the distribution indices by social groups in a hypothetical project:

(a) *Distribution index of the wage earners*

$$DB^w = \frac{VA^w}{VA} = \frac{10{,}000}{23{,}000} \times 100 = 43.48\%$$

The wage earners are expected to receive 43.48 per cent of the value added generated by the project in the form of wages and fringe benefits.

(b) *Distribution index of the profit earners*

$$DB^p = \frac{VA^p}{VA} = \frac{3,000}{23,000} \times 100 = 13.04\%$$

The domestic profit earners are expected to receive 13.04 per cent of the value added generated by the project as dividends, rents and fringe benefits. The repatriated portions of dividends, interest and rents are not accounted for here since the analysis is based on the net national value added only.

(c) *Distribution index of the Government*

$$DB^g = \frac{VA^g}{VA} = \frac{7,000}{23,000} \times 100 = 30.43\%$$

The Government is expected to receive 30.43 per cent of the value added generated by the project as taxes, dividends to state-owned shares, insurance charges and rents.

(d) *Undistributed value added*

$$\text{Undistributed} = \frac{VA^u}{VA} = \frac{3,000}{23,000} \times 100 = 13.05\%$$

A portion of the value added (13.05 per cent) is expected to remain in the firm. It will most likely be used for expansion funds, reserve funds as well as social welfare funds of the firm. The Government will have some control over the use of these funds so that it is done in compliance with the national objectives. The wage earners will undoubtedly benefit from it through the social welfare funds as well as through the expansion funds.

Therefore, the main beneficiaries of the implementation of the project are expected to be the wage earners and the Government. They would capture directly 73.91 per cent of the value added and would also derive the bulk of the benefits through the use of the undistributed value added.

Table 25 provides the data for computation of the regional distribution index:

$$DB^r = \frac{VA^r}{VA} = \frac{12,000}{23,000} \times 100 = 52.2\%$$

The region where the project will be located is expected to be the main beneficiary. It would capture 52.2 per cent of the value added as wages to local workers, profits to local entrepreneurs, taxes to local authorities and welfare gains to the region.

If the Government's objective is to distribute more benefits to the wage earners (to favour a labour-intensive technology), the project with a higher DB^w may be given a certain priority. If the objective is to promote the development of backward or politically sensitive regions, the project with a higher DB^r may be preferred.

The decision-making institution in a developing country usually determines the location of a project prior to its formulation and overall economic evaluation, on certain political, social or other grounds. Nevertheless, the above analysis is useful in supplying arguments either to confirm the decision already taken, to modify it if possible, or to show explicitly the "price" paid by the society for achieving certain non-economic objectives.

The data from table 26 could be conveniently used to derive the shares of the repatriated payments (RP) and net national value added (NNVA) within the net domestic value added (NDVA):

$$\frac{RP}{NDVA} = \frac{16,000}{39,000} \times 100 = 41.03\%$$

$$\frac{NNVA}{NDVA} = \frac{23,000}{39,000} \times 100 = 58.97\%$$

Therefore, a considerable portion (41.03 per cent) of the net domestic value added generated by the project would be repatriated abroad and would lower the net national value added. The project evaluator should bring this fact to the attention of the decision maker, and if the latter finds it too high, special attention should be given to the subject. One may explore possible ways and means of lowering the repatriations by mobilizing domestic sources of capital (loans and equity), re-examining the interest rates requested by foreign financial institutions, renegotiating the terms for foreign repatriations etc.

Net foreign-exchange effect

An essential part of the overall economic evaluation of an investment project is the assessment of the effects of its implementation on the foreign-exchange position of a country. This assessment is made in two stages:

(a) Assessment of the balance of payments effects of a project;

(b) Assessment of the import substitution effect of a project.

In countries where the shortage of foreign exchange is a key obstacle to economic development, the project's effect on the balance of payments has to be estimated first. In so doing, the present as well as the future balance of payments position should be accounted for since the present balance of payments shortage might be reduced or increased in the years to come. Also, the total effects of the project, direct and indirect, should be taken into consideration.

The analysis of the foreign-exchange effect of an investment project is important not only for countries facing a shortage of foreign exchange, but also for others that now enjoy a surplus balance of payments. The establishment of sophisticated industrial projects adds considerably to the import requirements of multifarious kinds: raw materials, components, replacements, machinery, purchase of know-how, technicians, royalty payments, repatriation of profits and so on. A project may help the country in manufacturing an important item or provide a substitute for an imported commodity, but at the same time it may add new items to the import schedule and impose many payment/repatriation obligations. It is, therefore, useful to make a comprehensive analysis of the effects of an investment project on the balance of payments.

When estimating the future balance of payments situation, some crucial problems should receive attention:

(a) The forces shaping the future balance of payments, such as unusually high or low prices for key exports and imports, large capital movements in terms of loans and foreign aid, temporary profitable exports and others;

(b) The trends in basic demand for imports and the supply of exports;

(c) The eventual changes of policy related to the import restrictions;

(d) Strategic significance of a product;

(e) Structure of trends of a product's demand in the world market.

The procedure of estimating the net foreign-exchange effect of a project could be carried out in four steps:

Step 1: Find the net foreign-exchange flows of a project. The assessment of the balance of payments effects of a project entails a systematic and careful analysis of the total inflows and outflows of the project in foreign currency, firstly, for each year of its construction and operation and, secondly, for its total economic life. The effects for each year will be important for the annual balance of payments statement of the country, and the sum total of the annual effects will depict the impact of a project on the overall foreign-exchange position of the country for the life span of the project. For this purpose it is important to compile a statement of all inflows and outflows of foreign exchange of a project.

Table 27 offers a standard format containing the essential items for calculation of the foreign-exchange inflows and outflows of an investment project. It provides a procedure for a liquidity analysis of the project in terms of foreign exchange.

It may be seen from table 27 that the foreign-exchange inflows and outflows include both direct and indirect flows, taking into account not only the flows directly connected with the project but also those in the linked projects. The presence of items related to foreign borrowing and to aid in table 27 indicates that, in fact, the liquidity analysis of a project in terms of foreign exchange is carried out on a yearly basis. The totals of the inflows and outflows for each year need not balance. Since all the inflows and outflows are expressed in foreign exchange, any positive FE_t will indicate that a project contributes to the availability of foreign exchange in the country in the year t, while a negative sign represents the amount by which the country's foreign-exchange availability is reduced by this project.

It should be possible to compile the above table from the data contained in the feasibility study or compiled earlier for ascertaining the commercial and national profitability of the project. Indirect inflows and outflows are the only new items required for this analysis and will have to be compiled if possible and if worth the effort.

In actual practice, there may be many factors during the economic life of the project which may substantially affect its foreign-exchange inflows and outflows. Bilateral or multilateral trade agreements, devaluation or re-evaluation of currencies, interplay of some abnormal forces of supply and demand of certain important items in particular years either on the domestic or international markets, changes in the import and export policies of the country, inflation and many other factors may have perceptible influence on the foreign-exchange inflows and outflows of the project. If any such factors are known with a degree of certainty, they would be reflected in the feasibility study, or in data compiled for earlier evaluation exercises. Since these same figures are being used for ascertaining the effects of the project on the balance of payments position of the country, they will be covered appropriately. It would be inconsistent and hazardous to introduce any new elements at this stage of evaluation. All factors that have not been considered thus far should be left to be covered in the sensitivity and probability analysis.

TABLE 27. FOREIGN-EXCHANGE FLOWS OF A PROJECT

(In foreign exchange)

Item	*Year*				
	t_0	t_1	t_2	...	t_n
I. Foreign-exchange inflows (FI)					
A. *Direct inflow*					
1. Foreign equity capital					
2. Loans in cash					
3. Foreign aid or grant					
4. Goods or equipment on credit or deferred payment[a]					
5. Exports of goods or services					
6. Others					
B. *Indirect inflow* (for linked projects)					
7. Capital					
8. Loans in cash and in kind					
9. Foreign aid or grant					
10. Export of goods or services					
11. Others					
II. Foreign-exchange outflows (FO)					
A. *Direct outflow*					
12. Survey, technical consultancy, engineering fees					
13. Import of capital goods, equipment, machinery, replacements etc.					
14. Import of raw materials, components, parts and semi-finished goods					
15. Imported goods purchased from domestic market					
16. Construction and installation charges					
17. Direct charges on imports of raw materials, intermediates, replacements etc. (payable in foreign currency)					
18. Salaries payable in foreign exchange					
19. Repayment of foreign borrowing					
20. Royalty, know-how and patent rights					
21. Repatriation of profits and capital					
22. Others					
B. *Indirect outflow* (for linked projects)					
23. Import of capital goods, equipment, machinery etc.					
24. Import of raw materials, intermediates, replacements etc.					
25. Imported goods purchased on domestic market					
26. Others					
III. Net foreign-exchange flow (I–II) (positive +; negative –)	FE_0	FE_1	FE_2	...	FE_n

[a]Not incorporated in cash loans.

If two or more projects are to be compared on the basis of the net foreign-exchange flows, all the $(FI - FO)_t$ should be multiplied by the respective discount factors to arrive at their present value, a single magnitude as a criterion for evaluation. Thus,

$$P(FE) = \sum_{t=0}^{n} (FI - FO)_t \, a_t \qquad (43)$$

where

P(FE) = present value of the total net foreign-exchange flow over the whole life of a project from year 0 to year n;

FI_t = foreign-exchange inflow of a project in the year t;

FO_t = foreign-exchange outflow of a project in the year t;

a_t = discount factor in the year t.

The present value of the net foreign-exchange flow over the whole economic life of a project could be a significant figure. It measures the project's net contribution to, or drain of, the foreign exchange of the country over this period. Other things being equal, the project with the largest net foreign-exchange flow will be considered for selection.

Step 2: Determine the impact of a set of projects on the national balance of payments. For the purpose of balance of payments planning and its relationship with an industrial complex or an investment programme, one further step in the analysis may be desirable. It consists of tracing the impact of a set of projects on the balance of payments situation of a country. Table 27 provides the foreign-exchange flows for each year of the life of a project and on this basis the total net foreign-exchange flow for each constituent project is computed. The annual figures for each project are summed up to obtain the annual net balance of payments effects of a set of projects. These figures are added to (deducted from) the national balance of payments surplus (deficit) prior to implementing this set of projects, to come to an expected residual (surplus or deficit) in the balance of payments after their implementation. The net impact of a set of projects on the balance of payments is presented in table 28.

The evaluation presented in table 28 should be carried out only at the level of an industrial complex or an investment programme and if the required data are available.

For individual projects, which are not an integral part of an industrial complex, or for an investment programme, step 2 of the analysis is not needed. The net foreign-exchange flow computed under step 1 above is actually the net impact of a project (positive or negative) on the national balance of payments. The project analyst should then proceed directly to the computation of the import substitution effect of a project.

Step 3: Compute the import substitution effect of a project. The import substitution effect measures the estimated savings in foreign exchange owing to the curtailment of imports of the items the production of which has been taken up by the project. This effect is calculated at the c.i.f. value of the quantity of previously imported (or would-be imported) items which will now be produced by this project and supplied to the domestic market.

TABLE 28. IMPACT OF A SET OF PROJECTS ON THE BALANCE OF PAYMENTS

(In foreign exchange)

Net foreign-exchange flows	*Year*			
	t_0	t_1	...	t_n
Project 1 = FE_1 Project 2 = FE_2 . . . Project m = FE_m				
Net balance of payments effects of a set of projects	$\sum_{i=1}^{m} (FE_i)_0$	$\sum_{i=1}^{m} (FE_i)_1$	...	$\sum_{i=1}^{m} (FE_i)_n$
Balance of payments surplus (deficit) prior to the implementation of a set of projects	S_0	S_1	...	S_n
Expected residual (surplus or deficit) in the balance of payments after implementation of the set of projects	$S_0 + \sum_{i=1}^{m} (FE_i)_0$	$S_1 + \sum_{i=1}^{m} (FE_i)_1$	...	$S_n + \sum_{i=1}^{m} (FE_i)_n$

Step 4: Compute the net foreign-exchange effect of a project. The net foreign exchange of a project includes the net foreign-exchange flow computed under step 1 and the import-substitution effect computed under step 3 above. The computation is shown in table 29.

In the case of commodities in large demand in the country, using the analysis in table 29 a negative foreign-exchange flow of a project during its whole economic life may even be converted into a positive figure of net foreign-exchange effects. This would be indicative of the import-substitution effect of the project.

TABLE 29. NET FOREIGN-EXCHANGE EFFECT OF A PROJECT

(In foreign exchange)

Item	*Year*				
	t_0	t_1	t_2	...	t_n
1. Net foreign-exchange flow (table 27, row III)					
2. Import-substitution effect					
Total net foreign-exchange effect (positive +; negative –)					

INTRODUCTION

TO

FINANCIAL ANALYSIS

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We will illustrate the kinds of accounts that are appropriate for the financial analysis of a processing enterprise that is a part of an agricultural project with examples adapted from the sugar mill included in the South Nyanza Sugar Project in Kenya. We will reproduce the figures for selected years; the original accounts were projected for sixteen years.

The overall South Nyanza project included establishment of a nucleus sugarcane plantation; development of a network of small farmers, or outgrowers, who would supply additional cane; and a processing component—a sugar mill initially capable of crushing 60,000 tons of cane a year, 90,000 tons of cane after later expansion. The accounts presented contain all the elements necessary for analysis of much simpler enterprises but are also complex enough to be useful as a pattern to be adapted by those with specialized knowledge of financial analysis.

For an agriculturally based industry included in a project, three basic financial statements should be prepared: balance sheets, income statements, and sources-and-uses-of-funds statements. If the project represents an expansion of an existing facility, then these accounts should include historical information for, say, about five years previous to the beginning of the project. Both for enterprises that are to be expanded and new enterprises, these statements would be projected over the life of the project.

The balance sheets give a view of the assets and liabilities of the processing enterprise at the end of each accounting period, which is usually a year—a kind of still photograph of the financial state of the enterprise at a given moment. The income statements summarize the revenues and expenses of the enterprise during each accounting period and give a kind of cinematic picture of activities over time. The sources-and-uses-of-funds statements are a summary of the financial transactions taking place during each accounting period. In essence, they convert the income statement to a cash (or funds) basis. They highlight large transactions, such as the purchase of assets and creation of new obligations (both debt and equity), that appear as changes in the balance sheets for the opening and closing of each period.

On the basis of these financial statements, the project analyst can form a judgment about the efficiency of current operations and about how efficient proposed new facilities are likely to be. He can assess the returns to investors if the project is to be financed by private funds or by accountable public enterprises. The statements may reveal losses that will have to be made up through a subsidy if the enterprise is to remain financially solvent; from them the analyst can examine the creditworthiness and liquidity of the enterprise during the project life as a basis for arranging its financing. In general, the project analyst will make use of three sets of ratios, which are derived from the financial statements and which give him insight to help form his financial judgments—efficiency ratios, income ratios, and creditworthiness ratios.

The financial data essential to analyze any new project are, of course, based on incremental expenses and revenues. The South Nyanza example for our discussion was a new project, and virtually the whole sugar mill was incremental. (There were a few existing assets.) Many projects, however, will entail expansion of existing facilities. In these instances, the analysis centers on incremental growth in the parent enterprise, the situation with and without the expansion that the parent enterprise will carry out. Costs and revenues that would be realized by the parent enterprise whether or not a particular project is undertaken are not considered in the estimate of the incremental contribution. On the one hand, the potential future effects of a proposed project must be isolated from the overall accounts of the parent enterprise. On the other hand, the project analyst will be concerned not only with the financial dimensions of a proposed expansion alone. He must also be satisfied that the parent enterprise is financially able to carry out the expansion, and that may require projecting financial statements for the enterprise as a whole, including the expansion envisioned by the project.

Accounts are kept for operating entities rather than for the persons who own, manage, or are otherwise employed by them. The enterprise represents a group of resources subject to common control. In financial analysis, it is the operating entity that is viewed as controlling the resources and receiving the income. The entity is, in turn, owned by its proprietors or shareholders. The management of the enterprise acts on behalf of the owners, whether private or government.

Accounts for operating enterprises are kept on an accrual basis. That is, revenues are recorded in financial statements for the period in which they are earned, and expenses are recorded in the period incurred, regardless of when the corresponding cash transactions took place. In contrast, cash accounting shows transactions only when cash payments are actually made. Governments generally keep their accounts on a cash basis, as do some small businesses. Public sector enterprises, however, normally follow the accrual principle because it is more useful for managerial decisionmaking.

The most common and generalized categories of items included in the accounts of the South Nyanza project appear in *italic* type in the text of this chapter. If the analyst takes the italicized items and the illustrative

tables as a general pattern and adapts them to the particular project he is working on, he will arrive at a satisfactory account for most simple processing enterprises. Conceptual errors would probably be limited and have little effect on the overall project investment decision, although the analyst may wish to verify his projected financial statements by consulting an accountant. Consultation with a financial analyst early in project preparation will probably be necessary when the financial statements for the processing plant become more complex.

Balance Sheet

The most well-known financial statement is the balance sheet. It is a snapshot of an enterprise at a particular point of time. In the South Nyanza example in table 5-1, the *assets* of the sugar mill are listed above and its *liabilities and equity* below. Assets and liabilities are listed according to the U.S. convention of showing the most liquid, or current, first and then progressing through less and less liquid forms to end with fixed assets and long-term liabilities. British usage shows the least liquid first,

Table 5-1. *Balance Sheets, Factory Capacity of 90,000 Tons, South Nyanza Sugar Company, South Nyanza Sugar Project, Kenya*
(thousands of KSh, constant 1977 prices)

Item	Project year 1	9	10	11
Assets				
Current assets				
Cash and bank balance	3,323	17,241	69,559	106,234
Accounts receivable—outgrowers[a]	2,952	47,202	48,047	48,471
Inventories				
Nucleus estate standing crop[b]	3,428	25,546	24,181	22,174
Other inventories[c]	1,525	7,000	7,000	7,000
Total current assets	11,228	96,989	148,787	183,879
Fixed assets				
Buildings and equipment at cost	34,549	469,736	472,094	479,923
Less accumulated depreciation	(2,872)	(207,498)	(241,560)	(275,741)
Construction in progress	84,437	—	—	—
Net fixed assets	116,114	262,238	230,534	204,182
Other assets	—	—	—	—
Total assets	127,342	359,227	379,321	388,061
Liabilities and equity				
Liabilities—current				
Accounts payable	—	—	—	—
Short-term loans	—	—	—	—
Long-term loans—current portion				
World Bank	—	6,563	6,563	6,563
European Investment Bank	—	10,956	10,956	10,956
East African Development Bank	—	2,846	2,846	2,844
Suppliers' credits—current portion				
Suppliers' credit—Germany	—	7,050	7,050	—
Suppliers' credit—India	—	6,381	6,331	—
Taxes payable	—	—	—	—
Total current liabilities	—	33,796	33,746	20,363
Liabilities—long-term				
Long-term loans				
World Bank	—	98,435	91,872	85,309
European Investment Bank	33,400	54,780	43,824	32,868
U.S. Export-Import (Exim) Bank	7,900	—	—	—
East African Development Bank	6,070	5,690	2,844	—
Suppliers' credits				
Suppliers' credit—Germany	17,200	7,050	—	—
Suppliers' credit—India	15,500	6,331	—	—
Total long-term liabilities	80,070	172,286	138,540	118,177
Total liabilities	80,070	206,082	172,286	138,540
Equity				
Share capital	57,000	196,500	196,500	196,500
Retained earnings	(9,728)	(43,355)	10,535	53,021
Total equity	47,272	153,145	207,035	249,521
Total liabilities and equity	127,342	359,227	379,321	388,061

KSh Kenyan shillings.
Note: Parentheses indicate negative numbers.
Source: Adapted from World Bank, "Kenya: Appraisal of the South Nyanza Sugar Project," 1418-KE (Washington, D.C., 1977; restricted circulation), annex 20, table 12.
a. Represents the net value of services and inputs provided to outgrowers (small farmers), including company overhead cost allocated to outgrowers.
b. Includes investment in sugarcane (current value less production cost of sugarcane; excludes value of land).
c. Includes spare parts, tools, and operating materials.

working through to the most current. (Also, if assets and liabilities are listed in parallel columns instead of at the top and bottom of a page, U.S. custom is to show assets on the left-hand side, whereas British usage is to put the liabilities on the left.) Assets and liabilities plus equity are defined so that they must always be equal. Thus we have the identity: assets = liabilities + owners' equity. Assets must be owned by the enterprise and be of measurable value. There are three principal kinds of assets: current, fixed, and other. *Current assets* consist of *cash*, including checking accounts in a bank; *accounts receivable*, which are amounts owed to the firm by customers and are expected to be converted into cash in the reasonably near future, usually in less than a year; and *inventories* intended for rather prompt sale. In the South Nyanza example, the standing crop of sugarcane on the nucleus plantation is treated as an inventory. *Fixed assets* include durable goods of relatively long life to be used by the enterprise in production of goods and services rather than to be held for sale. Property, plant and equipment, and land are the most common fixed assets. Often, as in the South Nyanza example, *buildings*

Table 5-2. *Income Statements, Factory Capacity of 90,000 Tons, South Nyanza Sugar Company*
(thousands of KSh, constant 1977 prices)

Item	Project year 1	9	10	11
Revenue				
Sale of sugar[a]	—	227,378	244,351	265,487
Sale of molasses[b]	—	9,194	9,880	10,734
Total revenue	—	236,572	254,231	276,221
Cash operating expenses				
Nucleus estate sugarcane production[c]	—	11,173	9,657	10,241
Outgrowers' sugarcane purchase[d]	—	72,296	80,532	85,404
Molasses—transport and excise tax[e]	—	5,412	5,815	6,318
Factory variable cost	—	15,133	16,263	17,670
Factory overhead	—	10,714	10,714	10,714
Total cost of goods sold	—	114,728	122,981	130,347
Gross income (profit)	—	121,844	131,250	145,847
Selling, general, and administrative expenses				
General administration	646	7,843	7,843	7,843
Training	37	267	267	267
Research	477	627	627	627
Management fee—nonvariable	1,121	1,210	1,210	1,210
Management fee—variable	—	3,890	4,225	4,886
Total selling, general, and administrative expenses	2,281	13,837	14,172	14,833
Funds from operations (operating income before depreciation)	(2,281)	108,007	117,078	131,041
Noncash operating expenses				
Depreciation				
Factory, general administration, research and housing assets	748	24,172	24,172	24,172
Nucleus estate and outgrowers' assets	2,124	15,628	18,160	20,125
Other	—	—	—	—
Total noncash operating expenses	2,872	39,800	42,332	44,297
Total operating expenses	5,153	168,365	179,485	189,477
Operating income (profit)	(5,153)	68,207	74,746	86,744
Nonoperating income and expenses				
Interest received	(—)	(4,245)	(4,770)	(5,048)
Interest paid	4,575	19,738	17,008	14,545
Duties and indirect taxes	—	—	—	—
Subsidies	(—)	(—)	(—)	(—)
Total nonoperating expenses	4,575	15,493	12,238	9,497
Income (profit) before income taxes	(9,728)	52,714	62,508	77,247
Income taxes	—	—	8,618	34,761
Net income (profit) after taxes	(9,728)	52,714	53,890	42,486

Source: Same as table 5-1 (annex 20, table 11).
a. Valued at KSh3,050 per ton.
b. Valued at KSh350 per ton f.o.b. Mombasa.
c. Represents total cost of production of sugarcane on the nucleus estate.
d. Value of sugarcane purchased from outgrowers at KSh155 per ton.
e. Includes excise tax of KSh6 per ton and transport charges of KSh10 per ton from factory to dockside in Mombasa.

and equipment at cost are shown at their original cost, and then the *accumulated depreciation* allowances are deducted. Land, by convention, is never depreciated. In the South Nyanza example, construction in progress is shown separately as a fixed asset. A third kind of asset, called simply *other assets*, is not needed in the South Nyanza balance sheet. This category would include investments in other companies or long-term securities; deferred expenses, such as start-up expenses for a new project, to be charged over several accounting periods; intangible assets such as patents and trademarks that have no physical existence but are of value to the enterprise; and miscellaneous additional assets peculiar to particular types of enterprises.

Liabilities are the claims against the assets of the enterprise that creditors hold—in other words, the outstanding debts of the enterprise. There are two principal kinds. *Current liabilities* comprise debts falling due within a year, such as *accounts payable*, *short-term loans*, and the *current portion* of *long-term loans* and *suppliers' credits* that must be paid within the coming accounting period. *Taxes payable* but not yet paid are also a current liability. *Long-term liabilities* are the debts that become payable after one year from the date of the balance sheet. They may consist of *medium-* and *long-term loans* and *suppliers' credits*.

Owners' *equity* consists of claims against the assets of the enterprise by its owners—in other words, what is left after all liabilities have been deducted from total assets. In the case of public sector enterprises, the owner is generally the government, although some public sector firms may have nongovernment shareholders. Owner's equity generally takes the form of *share capital* paid in by owners of the enterprise and *retained earnings* ("reserves" in British usage). Various other kinds of reserves may also appear under equity that do not fit precisely into the description of capital and retained earnings.

Income Statement

The income statement is a financial report that summarizes the revenues and expenses of an enterprise during the accounting period. It is thus a statement that shows the results of the operation of the enterprise during the period. Net income, or profit, is what is left after expenses incurred in production of the goods and services delivered have been deducted from the revenues earned on the sale of these goods and services. In other words, income (profit) = revenues − expenses. Thus, in the South Nyanza example in table 5-2, the net income is the sales revenue less all expenses.

Revenue in most processing enterprises will come from sales of goods and services—in the South Nyanza example, sugar and molasses. Sales are shown net of sales discounts, returned goods, and sales taxes.

The *cash operating expenses* list all the cash expenditures incurred to

produce the output. Important among these are expenditures for labor (which in the South Nyanza example is included in factory variable cost) and for raw materials, in this case largely sugarcane purchased from outgrowers. Subtracting these direct costs incurred in the production of the goods sold from the revenue gives the *gross income* (or *gross profit*).

Selling, general, and administrative expenses are shown next. These include a number of overhead items—in the South Nyanza example, general administration, training, research, and the management fee to be paid the firm that will operate the sugar mill. Maintenance costs are often included as a separate entry in this category.

We now reach the *funds from operations*, also called the *operating income before depreciation*. This is the net benefit or cash flow of the enterprise that arises from operations. If the account is built on an incremental basis, it is the incremental net benefit from operations. (It is *not* the incremental net benefit or cash flow for the enterprise as a whole during each year over the life of the project, since we must deduct the investment costs that come from the sources-and-uses-of-funds statement discussed in the next section. This expense is shown as depreciation in the income statement. See the last section of this chapter, on financial rate of return.) Funds from operations are sometimes also called the internally generated funds. *Funds from operations* becomes the first element in the sources-and-uses-of-funds statement and is also the basis for transferring the net benefits of the enterprise to the summary project accounts from which the estimated economic return of the project is derived. Before this is done, however, any element in the revenues, cash operating expenses, and selling, general, and administrative expenses that is a direct transfer payment or that has an economic value different from its market price must be omitted or revalued,

Next we list the *noncash operating expenses*, of which the primary element is *depreciation*. In accounting, depreciation refers to the process of allocating a portion of the original cost of a fixed asset to each accounting period so that the value is gradually used up, or written off, during the course of the useful life of the asset. Allowance may be made for the resale value of the fixed asset—its residual value—at the end of its useful life to the enterprise. The most common depreciation method is "straight-line depreciation," which allocates an equal portion of the value of the fixed asset to each accounting period; in contrast, various methods of accelerated depreciation allocate more of the depreciation to earlier accounting periods than to later. The principal *other* noncash operating expense is amortization, the gradual writing off of intangible assets such as royalties or patents.

Deducting the noncash operating expenses gives us *operating income* (or *operating profit*), also called the profit before interest and taxes.

Nonoperating income and expense are subtracted next. When an enterprise will receive interest payments, as is the case of the South Nyanza example, it is convenient to include *interest received* at this point, so that all interest transactions will appear at one point in the income statement. Interest received is thus shown as a "negative expense." In most enterprises, *interest paid* is among the most important nonoperating income and expense items. *Duties and indirect taxes* are also included among the nonoperating income and expenses unless they have been allowed for elsewhere. Duties, for instance, may appropriately be included among the expenses. In the South Nyanza example, duties on imported machinery were included in the purchase price of the machinery and thus were not shown separately under this entry. Indirect taxes also may not appear separately in income statements. In the South Nyanza example, we noted earlier that sales taxes were deducted before entering the sale revenues in accord with normal practice. In effect, the enterprise is simply acting on behalf of the government when it collects a sales tax, and the amount of the tax does not enter the income statement. In the South Nyanza example, the excise tax on molasses also was not shown separately but is properly included as part of the expenses. Among the indirect taxes that might be shown are franchise taxes and a value added tax—a tax levied as a proportion of the increased value generated at each stage in the processing and handling of a product up to the final sale. Finally appear *subsidies*. Again, subsidies may not appear at this point in the income statement. They may be incorporated elsewhere (for example, in the price that an enterprise pays for a subsidized input), or they may be shown as a revenue (as in the case of export incentive payments).

Thus we reach *income (profit) before income taxes*. Now, deducting the *income taxes*, we obtain the final entry, the *net income (profit) after taxes*. This is the return to the owners of the enterprise and is available either for distribution to them or for reinvestment in the enterprise.

Financial accounts must be linked to all other accounts. As the accountants put it, accounts must be "articulated." We noted that the *funds from operations* in the income statement becomes the first element in the sources-and-uses-of-funds statement. The income statement is also a bridge between successive balance sheets. The net income, after payment of dividends to shareholders, is transferred to the balance sheet as retained earnings and thereby increases the owners' equity. To trace this transaction, a reconciliation statement, such as a retained earnings statement, would be required to show any distribution of earnings as dividends before the retained earnings are added to the owners' equity in the balance sheet. In the South Nyanza example, it was assumed that all earnings would be retained by the enterprise throughout the sixteen years for which the projected accounts were prepared. Looking at years 9 and 10 reproduced in tables 5-1 and 5-2, we can see the articulation between the balance sheet and the income statement. The net income in year 10 given in the income statement in table 5-2 is KSh53,890 thousand. Adding this amount to the retained earnings at the end of year 9, shown in the projected balance sheets in table 5-1 to be −KSh43,355 thousand, gives a retained earnings in year 10 of KSh10,535 thousand (−43,355 + 53,890 = 10,535). Table 5-3 shows projected retained earnings statements for the South Nyanza example. Reconciliation accounts

Table 5-3. *Retained Earnings Statements, Factory Capacity of 90,000 Tons, South Nyanza Sugar Company*
(thousands of KSh, constant 1977 prices)

Item	Project year 1	9	10	11
Net income	(9,728)	52,714	53,890	42,486
Dividends	—	—	—	—
Increase in retained earnings	(9,728)	52,714	53,890	42,486
Accumulated retained earnings	(9,728)	(43,355)	10,535	53,021

Source: Same as table 5-2.

are uncommon for government-owned operating entities that retain all earnings in the enterprise.

Sources-and-Uses-of-Funds Statement

The sources-and-uses-of-funds statement highlights the movements of investment funds over the life of the project. It is a vehicle for measuring the total flow of financial resources into and out of an enterprise during an accounting period and for projecting this total flow into the future. The sources-and-uses-of-funds statement is also called the sources-and-applications-of-funds statement, the funds statement, the statement of change in working capital, or sometimes simply the cash flow, since the flow of funds is reflected in the final analysis by changes in the cash position of an enterprise. This accounting definition of cash flow, however, differs from that used in project analysis to measure the return on the resources engaged in the project.

The most common *sources* of funds are outlined in the first part of table 5-4. The first of these is *funds from operations* (or the *operating income before depreciation*). When the accounts are laid out following the pattern given here, this can be taken directly from the income statement as illustrated in the South Nyanza example. Often, however, the funds from operations does not show as a separate item in a set of accounts and will have to be constructed by adding depreciation and other noncash charges back to the operating income.

To the funds from operations are added the *increase in equity*, the *long-term loans received*, and the *increase (decrease) in short-term loans*. In the South Nyanza example, equity and loans come from a wide variety of sources. The government of Kenya contributes part of the equity financing that, in turn, it is to obtain from the proceeds of a World Bank loan, and part of the equity comes from a private firm. Long-term loans come from a variety of international financing institutions and from suppliers' credits. The capital structure of the firm is such that it does not need short-term loans in the years we have chosen as illustrative examples, but in many agricultural processing enterprises short-term loans would be needed to enable the enterprise to carry inventories of raw materials purchased at harvest time and stocks of processed goods that will be sold during the year.

Interest received is the next source of funds; in the South Nyanza example, it comes from short-term loans made to outgrowers. The *increase (decrease) in accounts payable and other short-term liabilities (except current portion of long-term loans received)* follows. An enterprise might obtain part of its funds by increasing the amounts purchased on terms from its suppliers or by postponing payment to its suppliers. If it reduces the amount purchased on terms or the average time it takes to pay its suppliers from one year to the next, this would cause a decrease in accounts payable and a reduction of the funds available. Because we are looking, in general, at an expanding firm that will be increasing its accounts payable in the normal course of widening the scope of operations under the project, an increase in accounts payable will usually be found in the sources-and-uses-of-funds statement. When a decrease occurs, however, it is convenient to enter it as a "negative source" in the accounts rather than as an additional line among the uses of funds. In some agricultural projects, the processing enterprise may be expected to operate at a loss to increase the income of farmers. If so, the firm may expect direct *subsidies* to be one source of its funds.

Among the major *uses* of funds (second part of table 5-4) in the projected sources-and-uses-of-funds statements for a project with an expanding processing enterprise will likely be the *increase (decrease) in gross fixed assets*. This item shows the investment in fixed assets during each year; in the South Nyanza example, this is principally investment in new milling capacity. In other cases an enterprise may decrease fixed assets by selling them. If this transaction exceeds the purchase of fixed assets, the net result would most easily be shown as a "negative use" among the uses of funds rather than as a separate entry for the proceeds from the sales of fixed assets among the sources of funds.

A major item in the projected sources-and-uses-of-funds statements for an enterprise included in an agricultural project will most likely be *repayment of long-term loans*. (Recall that among the sources of funds shown is the increase or decrease in short-term loans. Since this is shown on a net basis, there is no need for a separate entry among the uses of funds for repayment of short-term loans.) Only the principal repayment is included under the repayment of long-term loans. *Interest payments on long-term loans* and *interest payments on short-term loans* are segregated and shown separately. (In the South Nyanza example, the analyst assumed that the repayment of the short-term loans, shown as a decrease in short-term loans among the sources of funds, would be made at the very beginning of the accounting period; hence, there is no short-term interest shown in the account for year 9.) An enterprise that has borrowed for expansion, such as the South Nyanza Sugar Company, may have to pay *loan commitment fees* for undisbursed amounts of loans that have been made to it.

The *increase (decrease) in inventories* shows the change in the inventory position of the enterprise. Because most projected accounts are for expanding enterprises, it is likely that this entry will reflect an increase in inventories; the entry is therefore included among the uses of funds. Sometimes, however, there may be a decrease in inventories. Rather than have an additional line under sources of funds, it is convenient to treat a reduction in inventory as a negative use. In the South Nyanza example, the major inventory is the standing cane crop on the nucleus

Table 5-4. *Sources-and-Uses-of-Funds Statements, Factory Capacity of 90,000 Tons, South Nyanza Sugar Company*
(thousands of KSh, constant 1977 prices)

Item	Project year 1	9	10	11
	Sources			
Funds from operations (operating income before depreciation)	(2,281)	108,007	117,078	131,041
Increase in equity				
Government	54,150	—	—	—
Mehta Group	2,850	—	—	—
Total increase in equity	57,000	—	—	—
Long-term loans received				
World Bank	—	—	—	—
Suppliers' credit	32,700	—	—	—
European Investment Bank	33,400	—	—	—
Exim Bank	7,900	—	—	—
East African Development Bank	6,070	—	—	—
Total long-term loans received	80,070	—	—	—
Increase (decrease) in short-term loans	—	(19,000)	—	—
Total increase (decrease) in short-term loans	—	(19,000)	—	—
Interest received	—	4,245	4,770	5,048
Increase (decrease) in accounts payable and other short-term liabilities (except current portion of long-term loans received)	—	—	—	—
Subsidies	—	—	—	—
Total sources	134,789	93,252	121,848	136,089
	Uses			
Increase (decrease) in gross fixed assets[a]	118,956	22,445	10,628	18,064
Repayment of long-term loans				
World Bank	—	6,563	6,563	6,563
Suppliers' credit	—	13,431	13,431	13,381
European Investment Bank	—	10,956	10,956	10,956
Exim Bank	—	—	—	—
East African Development Bank	—	2,846	2,846	2,846
Total repayment of long-term loans	—	33,796	33,796	33,746

Table 5-4 (*continued*)

Item	Project year 1	9	10	11
Interest payments on long-term loans				
World Bank	—	11,370	10,681	9,992
Suppliers' credit	—	3,482	2,411	1,607
European Investment Bank	2,004	3,946	3,289	2,632
Exim Bank	711	—	—	—
East African Development Bank	668	940	627	314
Interest payments on short-term loans	—	—	—	—
Total interest payments	3,383	19,738	17,008	14,545
Loan commitment fees				
World Bank	984	—	—	—
Exim Bank	69	—	—	—
East African Development Bank	139	—	—	—
Total loan commitment fees	1,192	—	—	—
Total debt service	4,575	53,534	50,804	48,291
Increase (decrease) in inventories				
Standing cane crop	3,428	(827)	(1,365)	(2,007)
Other inventories[b]	1,525	—	—	—
Total change in inventories	4,953	(827)	(1,365)	(2,007)
Increase (decrease) in accounts receivable	2,952	2,295	845	424
Increase (decrease) in other short-term assets except cash	—	—	—	—
Income taxes paid	—	—	8,618	34,761
Dividends paid	—	—	—	—
Adjustments for items not covered above	—	—	—	—
Total uses	131,466	77,447	69,530	99,533
	Net funds flow			
Current surplus (deficit)	3,323	15,805	52,318	36,556
Opening cash balance	—	1,436	17,241	69,559
Cumulative surplus (deficit)	3,323	17,241	69,559	106,115

Source: Same as table 5-1 (annex 20, table 13).
a. Includes investment in the factory, agriculture, administration, housing, and company-related research.
b. Includes spare parts, tools, and operating materials.

plantation. As indicated in table 5-4, this inventory does decrease during years 9 through 11—thus it is shown as a negative entry in the account.

The *increase (decrease) in accounts receivable* appears next. If a firm is expanding, it will likely be extending credit to an increasing number of customers, and its accounts receivable will expand. But if it is able to reduce the average length between delivery and payment or be more restrictive in extending credit, its accounts receivable may decrease during the year and be shown as a negative use. The *increase (decrease) in other short-term assets except cash* would allow for changes in holdings of such short-term assets as notes, certificates of deposit, or treasury bills.

Income taxes paid are an obvious use of funds for an enterprise, and there may be *dividends paid* by the enterprise to its equity owners.

Finally, an entry for *adjustments for items not covered above* comprises those items that for various reasons do not fit well into one of the pattern categories. Any items of substance in this entry should be fully disclosed in footnotes to the accounts.

What remains is the *net funds flow*, of which the first element is the *current surplus (deficit)*. Adding the *opening cash balance* to the surplus or deficit gives the *cumulative surplus (deficit)*. If the projected accounts indicate a cumulative cash deficit—a deficiency of funds—then some arrangements will have to be made to sustain the enterprise during this period. It may be necessary to reduce planned dividends, arrange for additional loans or equity, or in some other way plan to provide the necessary funds.

Projecting the sources-and-uses-of-funds statements enables the analyst to be certain that the available financing for the enterprise will be sufficient to cover the investment program—including increases in inventories, other permanent working capital, and all cash expenditures for operations—and to cover obligations of interest and the principal repayment on all outstanding loans. Projecting the sources-and-uses-of-funds statements year by year makes it possible to check the timing of inflows from various sources to be certain that these inflows will be available as the need arises. Credit agencies can assess the total flow of funds from operations before debt service to determine how adequately the debt service is covered. Owners will be looking at the projected flow of funds after debt service to judge what their returns will be. For private investors, the funds generated after debt service and the projected dividends will be important elements in their decisions about whether to participate in the project.

Financial Ratios

From the projected financial statements for an enterprise, the financial analyst is able to calculate financial ratios that allow him to form a judgment about the efficiency of the enterprise, its return on key aggregates, and its creditworthiness. We will discuss several of the most significant of these ratios, but there are many others that financial analysts use and that are particularly appropriate for specific kinds of enterprises. For each ratio we will discuss, the means of computation is summarized in table 5-5. Two examples of the application of the ratios are given in the table, based on years 10 and 11 of the South Nyanza Sugar Company accounts reproduced in tables 5-1, 5-2, and 5-4.

In general, it is not possible to give ranges within which financial ratios should fall. Instead, the analyst will have to form a judgment about whether the ratio indicates an acceptable situation for the kind of enterprise that is the subject of the projected accounts. For more information about the use of financial ratios, the project analyst may consult a standard accounting text or Upper (1979), from which this discussion draws heavily.

The ratios given here have all been computed using the figures at the end of each year. This weights the analysis toward the last months of operations; as long as clarity and consistency are maintained, this usually poses no problem. If the activities of an enterprise are highly seasonal, as is often the case in agricultural projects, calculating the ratios on a year-end basis could easily be misleading. In that instance, the analyst may want to examine the pattern of seasonal fluctuations within the accounting period and make a judgment about whether the seasonal variation would affect his conclusions about the efficiency, return, or creditworthiness of the proposed enterprise.

Efficiency ratios

The first group of ratios (first part of table 5-5) enables the analyst to form a judgment about the efficiency of the proposed enterprise. They provide measurements of asset use and expense control.

Inventory turnover measures the number of times that an enterprise turns over its stock each year and indicates the amount of inventory required to support a given level of sales. The ratio can be computed in several ways. In the form given here, the cost of goods sold is divided by the inventory. In the South Nyanza example in table 5-5, for year 10 this amounts to 3.94 times a year. In agricultural processing industries, this ratio may be low compared with that of many manufacturing enterprises; this lower ratio reflects the highly seasonal nature of agricultural processing. The inventory turnover can also relate to the average length of time a firm keeps its inventory on hand. In the South Nyanza example, the firm has about ninety-three days of inventory on hand at the end of year 10. We determine this by dividing the days in the year by the inventory turnover ratio (365 ÷ 3.94 = 93). We could also state this in months—the firm has about three months of inventory on hand—by dividing the months of the year by the inventory turnover ratio (12 ÷ 3.94 = 3). A low turnover ratio may mean that a company with large stocks on hand may find it difficult to sell its product, and this may be an indicator that the management is not able to control its inventory effectively. A low turnover ratio may, however, also mean that large stocks must be held to ensure that production schedules are met. A low ratio means a sizeable amount of funds are tied up. A high turnover ratio may mean that the enterprise is able to recover its inventory investment rapidly and that there is a good demand for its products. On the one hand, when the ratio is much higher than the industry average, it may mean that the enterprise is very efficient in managing its inventories. On the other hand, it may mean that the enterprise is starved of funds and cannot afford to maintain a sufficient inventory; as a result, it may be forced to forgo sales opportunities.

The *operating ratio* is obtained by dividing the operating expenses by

Table 5-5. *Financial Ratios, Factory Capacity of 90,000 Tons, South Nyanza Sugar Company*

Ratio	Project year 10	Project year 11
	Efficiency ratios	
Inventory turnover = Cost of goods sold / Inventory	$\frac{122,981}{24,181 + 7,000} = 3.94$	$\frac{130,347}{22,174 + 7,000} = 4.47$
Operating ratio (percent) = Operating expenses / Revenue	$\frac{179,485}{254,231} \times 100 = 71$	$\frac{189,477}{276,221} \times 100 = 69$
	Income ratios	
Return on sales (percent) = Net income / Revenue	$\frac{53,890}{254,231} \times 100 = 21$	$\frac{42,486}{276,221} \times 100 = 15$
Return on equity (percent) = Net income / Equity	$\frac{53,890}{207,035} \times 100 = 26$	$\frac{42,486}{249,521} \times 100 = 17$
Return on assets (percent) = Operating income / Assets	$\frac{74,746}{379,321} \times 100 = 20$	$\frac{86,744}{388,061} \times 100 = 22$
	Creditworthiness ratios	
Current ratio = Current assets / Current liabilities	$\frac{148,757}{33,746} = 4.41$	$\frac{183,879}{20,363} = 9.03$
Debt-equity ratio = Long-term liabilities / Long-term liabilities + equity	$\frac{138,540}{138,540 + 207,035} = 0.40$	$\frac{118,177}{118,177 + 249,521} = 0.32$
and Equity / Long-term liabilities + equity	$\frac{207,035}{138,540 + 207,035} = 0.60$	$\frac{249,521}{118,177 + 249,521} = 0.68$
therefore Debt-equity ratio =	40:60	32:68
Debt service coverage ratio = (Net income + depreciation + interest paid) / (Interest paid + repayment of long-term loans)	$\frac{53,890 + 24,172 + 18,160 + 17,008}{17,008 + 33,796} = 2.23$	$\frac{42,486 + 24,172 + 20,125 + 14,545}{14,545 + 33,746} = 2.10$

Source: Tables 5-1, 5-2, and 5-4.

the revenue. In the South Nyanza example, for year 10 the operating ratio is 71 percent. The operating ratio is an indicator of the ability of the management to control operating costs; including administrative expenses. This ratio is most useful when operations of the same enterprise are compared year by year or when the enterprise is compared with similar industries. If the ratio is increasing, it may mean that the cost of raw materials is increasing, that the management is having problems controlling labor costs, that there is waste in the production process, or, when sales decline, that expenses have not been trimmed proportionately. It may also mean that there is substantial competition and that it is necessary to reduce prices. If there is uncertainty about whether the increase in the ratio is due to increasing costs or decreasing sales prices, the answer can usually be found by taking the operating expenses and dividing that by the company sales volume on a unit basis (for instance, the number of tons of refined sugar sold in the South Nyanza example). In general, the larger the capital investment is relative to sales volume, the lower will be the operating ratio. If a company has made a large investment, it must be able to recover it with a high cash flow, which can only be accomplished generally through a low operating ratio. If an enterprise has a high operating ratio, say in the neighborhood of 90 percent, it may have difficulty making an adequate return. If it is abnormally low, say 50 percent, then some costs have likely been omitted or underestimated.

Income ratios

The long-term financial viability of an enterprise depends on the funds it can generate for reinvestment and growth and on its ability to provide a satisfactory return on investment. We will look at three ratios (second part of table 5-5) that can be used to judge net income or profitability—*return on sales*, *return on equity*, and *return on assets*. Because of their importance in project analysis and because they are somewhat more difficult to calculate, we will defer to the next section consideration of three other income measures—the rate of return on all resources engaged, the rate of return on equity before income taxes, and the rate of return on equity after taxes.

Income ratios are calculated on a year-to-year basis and may be noted in the projected statements for an enterprise. That will provide some idea of the changing income ratios over the life of the project. If a company is granted a tax holiday for the first years of its operations, it is necessary to forecast its accounts through the end of the tax holiday period to determine the full effect of taxes on the company.

The return on sales shows how large an operating margin the enterprise has on its sales. This is determined by dividing the net income by the revenue. In the South Nyanza example, the return on sales in year 10 is 21 percent. The lower the return on sales—hence, the operating margin—the greater the sales that must be made to make an adequate return on investment. The ratio is most useful when comparing companies in the same sector or industry or when analyzing the results of past operations and comparing projections for future expansions. Comparisons among industries may have little meaning because of the widely varying structure of different industries.

One of the most important ratios is the return on equity. It is obtained by dividing the net income after taxes by the equity. In the South Nyanza example, for year 10 this is 26 percent. This ratio is frequently used because it is one of the main criteria by which owners are guided in their investment decisions. It can also be used to weigh incentives for individual owners if the enterprise is to be in the private sector.

The earning power of the assets of an enterprise is vital to its success. A principal means of judging this is to determine the return on assets, which is the operating income divided by the assets. In the South Nyanza example for year 10, this is 20 percent. The return on assets is the financial ratio that comes closest to the rate of return on all resources engaged (for more detail, see the next section). A crude rule of thumb is that, once the enterprise is operating at normal capacity, the return on assets should exceed the cost of capital in the society as measured by, say, the bank lending rate to industries—provided that there is no interest subsidy. Public sector enterprises usually should also be able to realize a return of this order, since if they do not, it is evidence that public funds would be better employed in other enterprises.

Creditworthiness ratios

The purpose of creditworthiness ratios (final part of table 5-5) is to enable a judgment about the degree of financial risk inherent in the enterprise before undertaking a project. They are also a basis for the project analyst to estimate what financing an enterprise will need and what will be suitable terms. Some firms, especially those in the private sector, attempt to finance their projects with as much debt as possible so they may realize maximum return on their own equity contribution. This can be risky, especially in an unstable industry or in an economy subject to substantial business cycles. An enterprise should be financed in such a way that it is able to survive adverse circumstances without emergency measures.

The *current ratio* is the current assets divided by the current liabilities. In the South Nyanza example, for year 10 the ratio is 4.41. From the standpoint of the credit agency, the current ratio is an indication of the margin that the enterprise has for its current assets to shrink in value before it faces difficulty in meeting its current obligations. In the South Nyanza example, in year 10—even if the current assets are worth only one-fourth the value given in the accounts—the sugar mill could still pay its creditors from these assets.

A rule of thumb sometimes applied to the current ratio is that it should

be around 2. As with all rules of thumb, this figure should be used with caution. If the company has a rapid inventory turnover and can easily collect its receivables, the current ratio can be lower. If the ratio drops to near 1, then the enterprise will be in a potentially unstable position. If the ratio is low, it may mean that the enterprise is undercapitalized, and consideration will have to be given to providing more capital, either through increased equity or more long-term debt. Faced with a low current ratio, an enterprise will have to exist on a day-to-day basis, and thus it may have to adopt uneconomic practices. Its products may have to be sold at lower prices to receive payment in cash, or it may lose sales to competitors that can offer better credit terms. It may not be able to carry sufficient inventories to meet its sales needs. Inventories of raw material may be so low that its production efficiency is impaired. It may have to buy from importers in high-cost, small lots instead of buying large, low-priced shipments of inputs direct from overseas suppliers, and it may be forced to buy on credit instead of being able to take advantage of cash discounts. With a low current ratio, an enterprise may be forced to defer preventive maintenance, and this drives up costs later.

An important financial ratio for credit agencies is the *debt-equity ratio*. The amount of equity an enterprise can be described as a "cushion" by which a company can absorb initial losses or weather bad times. Because debt carries a charge of interest and fixed repayment of principal, too much debt may saddle a company with obligations it cannot meet when conditions are unfavorable. (A better measure of the cushion is the *debt service coverage ratio*, discussed below.)

The debt-equity ratio is calculated by dividing long-term liabilities by the sum of long-term liabilities plus equity to obtain the proportion that long-term liabilities are to total debt and equity, and then by dividing equity by the sum of the long-term liabilities plus equity to obtain the proportion that equity is of the total debt and equity. These are then compared in the form of a ratio. In the case of the South Nyanza example, for year 10 the long-term liabilities divided by the sum of the long-term liabilities plus the equity is 0.40. The equity divided by the sum of the long-term liabilities plus equity is 0.60. The debt-equity ratio, therefore, is 40 to 60. This may be interpreted as saying that, of the total capitalization in the enterprise, 40 percent is debt and 60 percent is equity. There is no good rule of thumb for the debt-equity ratio. In newly established enterprises, equity ideally should exceed the debt, but in many developing countries equity capital may be scarce, and such a conservative rule may not be sensible given the national objectives. If the enterprise is in the public sector, with a high proportion of the debt held by public sector agencies, the debt-equity ratio may lose some of its importance because of the presumption that, if the company falls on hard times, it will be possible to renegotiate some portion of the debt held by public agencies. In agricultural projects, enterprises are likely to need a strong equity base because they process or sell commodities that may sharply fluctuate in price and that are subject to adverse weather conditions or a fall in crop or livestock production.

The most comprehensive ratio of creditworthiness is the *debt service coverage ratio*. This is the net income plus depreciation plus interest paid divided by interest paid plus repayment of long-term loans. In the case of the South Nyanza example, for year 10 the debt service coverage ratio is 2.23.

The debt service coverage ratio could also be calculated on a before-tax basis, in which case it is simply the funds from operations divided by the interest plus repayment of long-term loans. In the case of the South Nyanza example, for year 10 (not shown in table 5-5) this would be 2.30 [117,078 + (17,008 + 33,796) = 2.30]. Financial analysts who use the after-tax basis argue that taxation is a routine and unavoidable aspect of doing business. But analysts who prefer the before-tax basis argue that debt service coverage should be seen as the ability of funds from operations to satisfy debt obligations before such tax shields as depreciation and other noncash charges are applied to reduce taxable profits. The viewpoint of the analyst will be affected by whether the company is in the public or private sector.

Again, it is hard to give a rule of thumb for the debt service coverage ratio. One way of looking at it is that, in the case of the South Nyanza Sugar Company in year 10, the net income plus depreciation plus interest paid could drop by half and the enterprise could still meet its debt obligations. The analyst would have to look at each of the elements making up the ratio and form a judgment about how likely it is that any element could vary from the projected amount. A declining trend in the debt service coverage ratio in a projected account might indicate overly ambitious expansion. A persistently low debt service coverage ratio might indicate that consideration should be given to changing the credit terms to lengthen the repayment period.

The debt service coverage ratio interpreted alone can be misleading. There are many requirements that a successful enterprise must satisfy in addition to simply covering its debt service obligations. A full analysis of the sources and uses of funds for the enterprise is needed. The true buffer for debt service is only the pool of funds remaining after meeting all requirements for maintenance and improvement of current operations and orderly expansion.

Financial Rate of Return

A useful financial measure that is very important in project analysis is the financial rate of return. We will discuss three variations that differ only in the standpoint from which the calculations are made—the financial rate of return to all resources engaged, the financial rate of return to equity, and the financial rate of return to equity after taxes.

Calculations of rates of return are based on an incremental net benefit flow. This is the "cash flow" that is meant by references to discounted cash flow measures of project worth such as the net present worth, the internal rate of return, or the net benefit-investment ratio (all are dis-

cussed in detail in chapters 9 and 10). In this section we will discuss only derivation of the incremental net benefit; the discussion of discounting and of the measures based on incremental net benefit flows will be found in chapter 9.

In rate of return calculations we want to determine the actual cash inflows and outflows of the project each year and incorporate them in the incremental net benefit. Noncash receipts and expenditures are omitted (except for items in kind)

. Thus, the year an investment is made it reduces the net benefit for that year; when a revenue is realized, it too is reflected in the same year it is received. Because we are preparing the projected accounts over the life of the project, it is unnecessary to include depreciation (which is the major noncash expenditure in most accounts) to allow on an annual basis for the capital value consumed during the year.

From the projected income statements and sources-and-uses-of-funds statements for an enterprise as we have laid them out, we can determine the incremental net benefit streams we need to calculate the financial rate of return. The general format is given in table 5-6 and is illustrated by the South Nyanza Sugar Project accounts examined in tables 5-2 and 5-4. All the relevant entries are included in table 5-6 for illustrative purposes, even if the South Nyanza example did not use a particular entry. The entries appear in the order they are found when consulting

Table 5-6. *Derivation of Incremental Net Benefit, Factory Capacity of 90,000 Tons, South Nyanza Sugar Company*
(thousands of KSh, constant 1977 prices)

Item	Without project	Project year 1	9	10	11
Inflow					
Revenue	—	—	236,572	254,231	276,221
Subsidies	—	—	—	—	—
Total inflow	—	—	236,572	254,231	276,221
Outflow					
Cash operating expenses	—	—	114,728	122,981	130,347
Selling, general, and administrative expenses	—	2,281	13,837	14,172	14,833
[Funds from operations]	—	[(2,281)	108,007	117,078	131,041]
Duties and indirect taxes	—	—	—	—	—
Increase (decrease) in gross fixed assets	—	118,986	22,445	10,628	18,064
Increase (decrease) in inventories	—	4,953	(827)	(1,365)	(2,007)
Total outflow	—	126,220	150,183	146,416	161,237
Net benefit before financing					
Total	—	(126,220)	86,389	107,815	114,984
Incremental	—	(126,220)	86,389	107,815	114,984

Table 5-6 (*continued*)

Item	Without project	Project year 1	9	10	11
Financing					
Long-term loans received	—	80,070	—	—	—
Increase (decrease) in short-term loans	—	—	(19,000)	—	—
Interest received	—	—	4,245	4,770	5,048
Increase (decrease) in accounts payable and other short-term liabilities	—	—	—	—	—
Repayment of long-term loans	—	—	(33,796)	(33,796)	(33,746)
Interest payments	—	(3,383)	(19,738)	(17,008)	(14,545)
Loan commitment fees	—	(1,192)	—	—	—
Decrease (increase) in accounts receivable	—	(2,952)	(2,295)	(845)	(424)
Decrease (increase) in other short-term assets except cash	—	—	—	—	—
Net financing	—	72,543	(70,584)	(46,879)	(43,667)
Net benefit after financing					
Total	—	(53,677)	15,805	60,936	71,317
Incremental	—	(53,677)	15,805	60,936	71,317
Income taxation					
Income taxes paid	—	—	—	8,618	34,761
Net benefit after financing and taxes					
Total	—	(53,677)	15,805	52,318	36,556
Incremental	—	(53,677)	15,805	52,318	36,556

Financial rate of return to all resources engaged = 14 percent[a]
Financial rate of return to equity before income taxes = 16 percent[b]
Financial rate of return to equity after taxes = 13 percent[c]

Source: Tables 5-2 and 5-4.
a. Calculated from the incremental net benefit before financing. For details about the methodology of the computation, see chapter 9.
b. Calculated from the incremental net benefit after financing.
c. Calculated from the incremental net benefit after financing and taxes.

first the income statements and then the sources-and-uses-of-funds statements. Only the rate of return is usually reported. Were the table itself to be used in a project report, it might be desirable to group the entries so that related items are not separated.

The first financial rate of return to be determined is the *financial rate of return to all resources engaged*, which is a measurement of the financial viability of an enterprise. It is based on the *incremental net benefit before financing*. In the South Nyanza example, the rate of return to all resources engaged, assuming a thirty-year life for the project, is 14 percent. When all the elements that enter into the derivation of the incremental net benefit before financing are revalued to reflect economic values and any transfer payments are taken out, the

incremental net benefit before financing becomes the basis for aggregating the net economic benefit from the enterprise and carrying it into the economic accounts for the project.

To obtain the incremental net benefit before financing, we begin with the *revenue* and direct *subsidies* received; these are taken from the income statements, which total to give the *total inflow*. The first two entries among the outflows are the *cash operating expenses* and the *selling, general, and administrative expenses*, also taken from the income statements. (At this point, if there were no direct subsidies, we would have the *funds from operations*; an alternative calculation of financial rates of return would therefore be to begin with the funds from operations, add any direct subsidies, and deduct any of the other elements of the outflow that are relevant.) Continuing with the outflow entries, we add *duties and indirect taxes* as shown in the income statements and add or subtract, as appropriate, the *increase (decrease) in gross fixed assets* and the *increase (decrease) in inventories* as shown in the sources-and-uses-of-funds statements. The result is the *total outflow*. Subtracting the total outflow from the total inflow provides the *total net benefit before financing*. Subtracting what would be the net benefit without the project (which, in the South Nyanza example, is nothing), we now reach the incremental net benefit before financing.

The *financial rate of return to equity before income taxes* will be an important consideration to any potential private investors. It is also of concern if the enterprise is to be a financially responsible public sector enterprise that must demonstrate the good use it makes of resources put at its disposal. The return to equity before income taxes will help the project analyst judge the attractiveness of the proposed enterprise to potential investors and to determine if the financing plan will give rise to undue windfall profits. It may also help in deciding what special tax holiday or other exemption may be justified. For the South Nyanza example, the return on equity before income taxes is 16 percent. To determine the return to equity before income taxes, we need to calculate the *incremental net benefit after financing*, and to reach this we add or subtract the financing elements shown in the sources-and-uses-of-funds statements, indicating the sign in the account as we proceed. Note the inclusion of *accounts payable* and *accounts receivable* as part of the financing. Because a decrease in accounts receivable increases the funds available to the enterprise, it is decreases that are added to obtain the net financing. The heading on these entries has been reversed from that in the sources-and-uses-of-funds statements to indicate that decreases are to be added and increases subtracted. Finding the algebraic total gives the *net financing*, and subtracting that from the net benefit before financing gives the *total net benefit after financing*. Subtracting the without-project net benefit after financing (in this case, nothing), we reach the incremental net benefit after financing.

Finally, we determine the *financial rate of return to equity after taxes*, which is based on the *incremental net benefit after financing and taxes*. For the South Nyanza example, it is 13 percent. To determine the incremental net benefit after financing and taxes, we deduct income taxes from the net benefit after financing and subtract the without-project amount (in this case, nothing). This is the flow that will accrue to the equity owners after the enterprise has met its tax obligation. It is, of course, this flow that is of most concern to potential investors, and so the rate of return to equity after taxes is an important measure on which to base judgments about the incentives to invest in an enterprise.

INTRODUCTION

TO

MS-DOS

AND

SOME MS-DOS Commands

MS - DOS

WHAT MS-DOS DOES

You might think of MS-DOS as similar to the cockpit of an airplane. Without it, there is plenty of potential, but you cannot fly the airplane. The operating system allows you /the pilot/ to control your computer by telling it "where to go" and what to do. Like the controls in an airplane's cockpit, the operating system coordinates the parts of the computer and gives you an easy method for controlling them. In this chapter, you will begin to learn how MS-DOS performs this role.

MS-DOS is an acronym for MicroSoft Disk Operating System; it is a generic name for the operating system that is licensed by Microsoft Corporation for use on several microcomputers made by different manufacturers. /Some of these computer manufacturers have altered MS-DOS for their computers and given it a new name, such as PC-DOS or Z-DOS/.

From the name **disk operating system** /or DOS/, you might think that all MS-DOS does is manage your disks. The term DOS has remained in the technological vocabulary because many years ago operating systems did little more than control disks. MS-DOS does much more than this, however. It provides a way to tell the computer which program or command you want to run, where it will find the program or command, and what it should do with it. For instance, it might send information to the display screen, to a printer, or to a communications port to be sent to another system. The operating system can be thought of as working on two levels.

The first level is that of a hardware management system: MS-DOS coordinates your computer's **central processing unit** /CPU/ /which is the microprocessor chip that acts as the "brains" of your computer/ with the rest of your computer's hardware. In this capacity MS-DOS takes the character you type on your computer's keyboard, codes it into a form that the CPU can understand, and then displays it on your monitor in a form that you can understand. For instance, if you

are using a spreadsheet or word processing program, MS-DOS acts as the go-between that converts the electronic signals your keyboard generates into control codes that your application program can use. MS-DOS also performs small tasks that are related to using programs, such as formatting a disk or telling you what files are on a disk.

The second level on which MS-DOS operates is the utility function. In this capacity, MS-DOS executes **commands**, which let you interact directly with your computer. These commands perform such functions as naming files on the disk or copying files from one disk to another.

MS-DOS treats its own commands just like application programs. These commands, however, are more limited than are most application programs. They do not perform tasks like word processing or accounting; instead, they are used for maintaining and housekeeping your computer. Each command has a name that is usually easy to remember. For example, to copy information from one disk to another, you use the COPY command.

Communicating with Your Hardware

The CPU in your computer can't function well without an operating system. It needs a master traffic manager to coordinate all of the information that it gets from the keyboard, the disk drives, and other hardware in your computer. MS-DOS coordinates the hardware, and it lets the CPU communicate with almost any other part of your computer. For example, without the operating system, the CPU has no way to find data and programs on the disks.

After you load the operating system /usually when you first turn on your computer/, it is kept in the computer's random-access memory /**RAM**/. RAM is like a huge scratchpad filled with numbers and instructions; as a program runs, it reads some of the contents of RAM and changes some of the information in it. RAM memory is temporary; that is, it is only maintained by the electric power in your computer. When you turn off your computer, all of the information in RAM is forgotten /which is why a power failure can be so disastrous when you are using your computer/. Any information in RAM is lost

as soon as power is cut, even if it is off for just an instant. A few of the MS-DOS computers have a battery backup, which prevents RAM from losing data during power failures.

Although the CPU does not need help from the operating system to communicate with RAM, it is important to know a bit about RAM since that is where all of your programs stay while they are being run. You can imagine RAM as being like a set of many boxes called bytes. Each **byte** is equal to the amount of memory needed to store a single keyboard character /like a Q or a @/. The amount of RAM that you have in your computer is measured in **K**, or **kilobytes**. A kilobyte equals 1024 bytes.

Returning to the analogy of RAM as a set of boxes, you can imagine each byte, or box, to be divided into eight compartments, called **bits**, which are either full or empty /see Figure 1/. As you can see, each box has a number, known as its **address**, which tells its position in RAM. The CPU constantly uses these addresses to access the contents of the boxes. The CPU also receives data from outside sources /such as the disk or the keyboard/ and places it in RAM. The contents of RAM are altered as it performs tasks like calculations and comparisons of numbers.

The process of putting data into RAM from sources like the keyboard, and alternately taking information from RAM and sending it to a different hardware device like the display screen, is called **I/O**, or **input/output**. Every time that you "read" information from some hardware device like a disk drive, or "write" information to a hardware device like a printer, MS-DOS performs I/O.

A **device** is simply a piece of hardware that uses I/O. For instance, a printer is a common device that you probably use; other common devices are disk drives and monitors. Most MS-DOS computers have plugs /called **ports**/ to connect them to other hardware devices. The two common types of ports are **serial** and **parallel**. The difference is based on internal methods that the device connected to the port uses to communicate with the computer. This difference between the

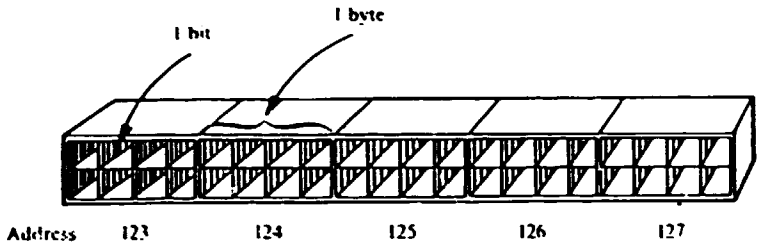

Figure 1. Example of bits and bytes

two methods does not affect the performance of the device, but it does mean that you have to be careful in selecting the proper type of device for the ports on your computer. You cannot connect a serial printer to a parallel printer port or vice versa; nothing will happen. /Generally, only printers are attached to parallel ports; most other external devices, such as modems, are attached to serial ports/.

When the CPU needs to communicate with other hardware, it simply calls on the portion of the operating system that knows about your hardware. All of these processes happen in a matter of microseconds - so quickly that you often don't value the importance of what is being accomplished. For instance, if you run a word processing program, the program will aks MS-DOS for each character you type on the keyboard. In this case, the program tells MS-DOS, "I'm ready for a keyboard character; has the user typed one? If not, I'll wait until it is typed".

Running Application Programs

You may have noticed that the last example described a process of communication, not just between hardware devices, but between hardware and a software application program. The second important part of MS-DOS's traffic manager role is to help your programs run smoothly. Any program that you run can ask the operating system for help in communicating with your hardware. For example, a word processing program may need to know how many disk drives you have in your computer.

Instead of having to know all of the computer commands to figure this out, it can just ask the operating system.

In its role as the intermediary between the CPU and an application program MS-DOS performs two important tasks for you: it gets the program you want to run and places it in RAM, and it helps the program perform I/O. For instance, when you tell MS-DOS that you want to do word processing, you are really instructing it to get the word processing program off the disk, load it into RAM, and tell the CPU where in the program to start.

The operating system also translates an application program's requests into a standard language so that the same program can be used on different computers. This is why you can use some programs on computers made by many different manufacturers. For instance, a program can say to the operating system. "Print these characters on the screen" without having to know anything about what that particular computer requires for its display. Thus, even though computers that run MS-DOS may be quite different, a program can run on any of them since MS-DOS helps it communicate with the hardware in a standard way.

Most people who use MS-DOS as their operating system do so because there are so many application programs for it. However, since some software is written for other operating systems /such as CP/M/, not every application program will run on your computer. You must be sure that the program you buy runs with MS-DOS as its operating system or you will not be able to use it on your MS-DOS computer. Since some programs require certain hardware, such as a specific printer or a certain amount of RAM, you should be sure that you have the correct hardware necessary before buying any software.

You have seen how MS-DOS takes information from one device and transfers it to another. This process occurs so commonly in the day-to-day transfer of information to and from disk files that it is worthwile to look more closely at what files are and how they are stored on disks.

HOW MS-DOS USES DISKS AND FILES

When you save data on a disk, the information is stored in a file. Storing information in files is like organizing data into file folders in a filing cabinet. A **file** is a collection of information identified with a unique name that you assign. Files are basic to using your computer; without them, your work would be lost when your computer was turned off.

The information in a file may consist of text /such as a memo/, data /such as a mailing list/, or a program /such as word processing/. The file can be any lenght, limited only by the space available on the disk on which it is stored. When you want a program to work on a file /either to get information out of the file or to add information to the file/, you simply use the command to access a file and tell the program the file's name. Files are stored on disks or diskettes. A **disk** is a round piece of rigid material covered with magnetic media; a **diskette** /or floppy disk/ is a flexible version of a disk.

What happens when MS-DOS retrieves stored files from a disk for you? The disk spins at a high speed while the disk head moves in and out /a disk head is similar to the heads on a tape recorder/. The movement is similar to selecting a song on a record player. When you ask to look at a file, the head first moves to the **directory**, a special area on the disk that holds information about each file. It finds the location of the file you want and then moves to that file on the disk.

You may wonder how the disk head finds the file. There are entries in the directory that contain two numbers for each file: the **track** and the **sector**. MS-DOS uses this information to pinpoint the location of each file on the disk. The number of bytes in each sector is constant on a disk, but different disk drives or your computer may have different numbers of bytes per sector and different numbers of sectors per track. Fortunately, MS-DOS keeps all of this straight for you.

Figure 2 illustrates tracks and sectors on a diskette. The track number is essentially a measure of how far the file is from the edge of the disk. Tracks are concentric rings on the disk.

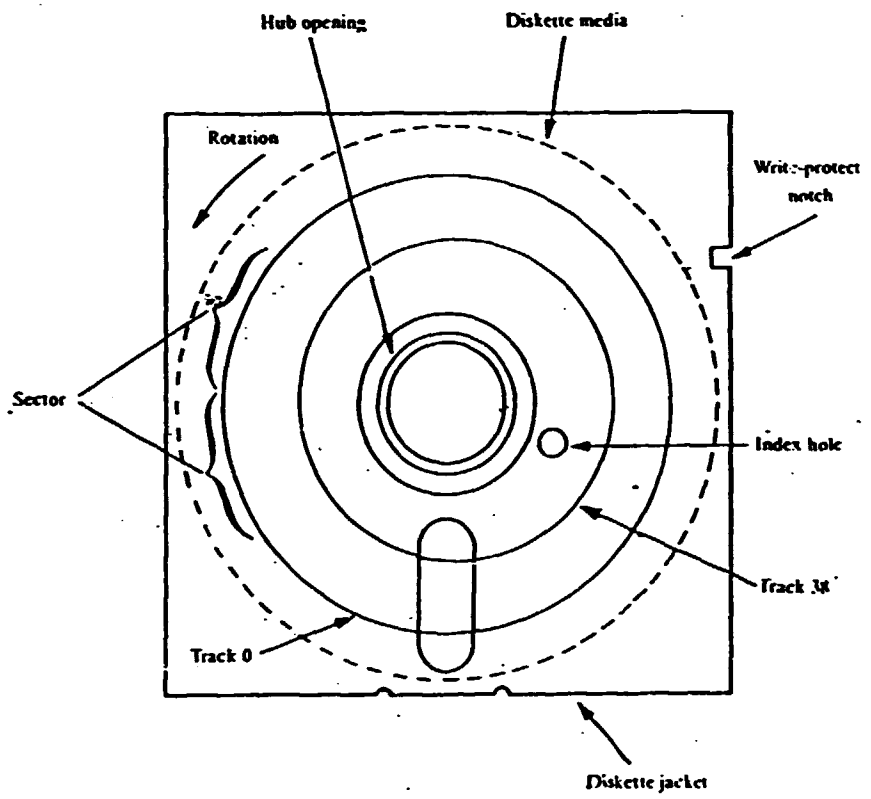

Figure 2. Tracks and sectors on a disk

Since each track can contain a great deal of information, tracks are divided into sectors. Continuing the record analogy, tracks are like grooves, and sectors are like portions of one groove. Sectors are measured from a fixed point counterclockwise all the way around and back to the beginning point on the disk.

Thus, the directory entry tells the disk head how far out on the disk to look and how long to wait during a rotation before it should start reading information. Finding a particular track is similar to selecting a song on a record.

The **disk drive** is the mechanism that holds the disk. Almost every MS-DOS computer has at least one disk drive. The two main types of disk drives are distinguished by the types of disks they use: floppy or hard disks. There are two main differences between floppy and hard disks: hard disks hold much more data than floppy diskettes, and they can access their data about ten times faster. A floppy diskette usually holds between 150 and 750K; a hard disk often holds between 5000 and 20,000K, about 25 times as much. /Hard disk capacity is often measured in **megabytes**. A megabyte is 1000K; a 5M hard disk holds 5000K./ Of course, hard disks cost much more than floppy diskettes.

You may have heard of another form of "disk drive" called a **RAM disk**. It is really not a disk drive at all, but a way of making MS-DOS think that part of the RAM in your computer is a disk drive. Since reading and writing to RAM is about five to ten times as fast as reading and writing to a hard disk /and incredibly faster than a floppy diskette/, programs that use a lot of disk accesses /such as word processing and accounting/ run much faster when a RAM disk is used.

If you have at least 128K of extra RAM in your computer, you can run a RAM disk program that will separate that RAM from the rest of the system. After it is separated, the program will make MS-DOS think that the information stored in this RAM is information stored on another disk drive. This means that you can now copy to and from the RAM with the same commands you use to copy to and from disks. Since the information in RAM is lost when you turn off your computer, you must copy all files from the RAM disk to another disk in order to save them.

LOOKING INSIDE MS-DOS

Many people run their MS-DOS computers for years without knowing anything about what MS-DOS is doing for them. But a little understanding of how MS-DOS works can help you use your operating system effectively. It can also help you determine the limits of

what you can expect MS-DOS to do.

If you could look inside MS-DOS, you would see a very complicated mass of computer instructions. These instructions are written in **machine language**, which is a special language that your CPU knows how to read /many application programs are also written in machine language/. Fortunately, you do not need to know machine language in order to use MS-DOS. Nor do you need to know how MS-DOS does its job. However, the process by which MS-DOS runs programs is not hard to understand, and it is helpful to know something about it, especially when you are giving commands directly to MS-DOS.

How MS-DOS Runs Command

The processes discussed in this section relate to the utilities function of MS-DOS. MS-DOS is like a program that is always working. When you first turn on your computer, MS-DOS is read from disk into RAM and begins running. When MS-DOS is ready for you to give it a command or run a program, it displays a **prompt** on the screen and waits for you to tell it what to do. A prompt is simply a signal indicating that a program /in this case, MS-DOS/ is waiting for you to type something.

The MS-DOS prompt, usually A > or C >, tells you that the MS-DOS **command interpreter** is waiting for you to tell it what to do next. The job of the command interpreter is to read commands that you give to MS-DOS, find the program or command you want to run, and start it running. /In the rest of this section, the word "command" will be used, but the process applies equally to any program that MS-DOS will run./

To run a command, you simply type its name on the keyboard. MS-DOS displays the characters on the screen as you type them. Then you press the RETURN key, which is usually in the middle row of the right column of the alphabetic keys. It may also be marked with a symbol such as an arrow pointing down and to the left. On some computers, this key may be labled ENTER.

After you tell MS-DOS the command name, the operating system must find the command program. It has two choices of where to find it. A command can be in either internal or external storage. **Internal** commands are built right into MS-DOS itself. This means that MS-DOS does not have to look on a disk for them since they are loaded into RAM with the rest of MS-DOS. Other commands are **external.** Whenever you run these commands, MS-DOS must read them from the disk before it can execute them. /About half of MS-DOS's commands are external./ A **bath file** is a special type of a set of MS-DOS commands. Figure 3 shows the steps the operating system follows when you tell it to run a command.

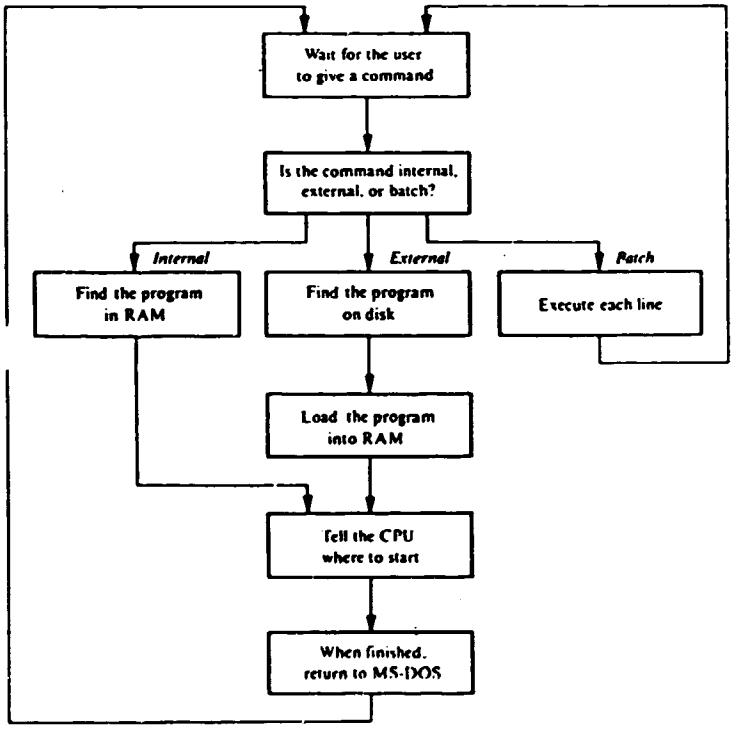

Figure 3. How MS-DOS runs a program

There is no difference in the way in which you tell MS-DOS to run external or internal commands. Therefore, you often don't have to know what type of command you are asking MS-DOS to run. You can ignore the differences for now, but later you may wish to know if a command is external or internal.

When you run an external command, you must be sure that the disk that has the command on it is in the disk drive. If it is not in the drive /or if you have misspelled the command name/, MS-DOS will give the **error message** "Bad command or file name". Error messages, as you might guess from their name, are simply communications by which MS-DOS lets you know that there is something wrong.

Remember that MS-DOS is always kept in RAM, even when you tell it to run a command or an application program. When you run a command, MS-DOS loads it into the memory adjacent to the operating system, as is shown in Figure 4.

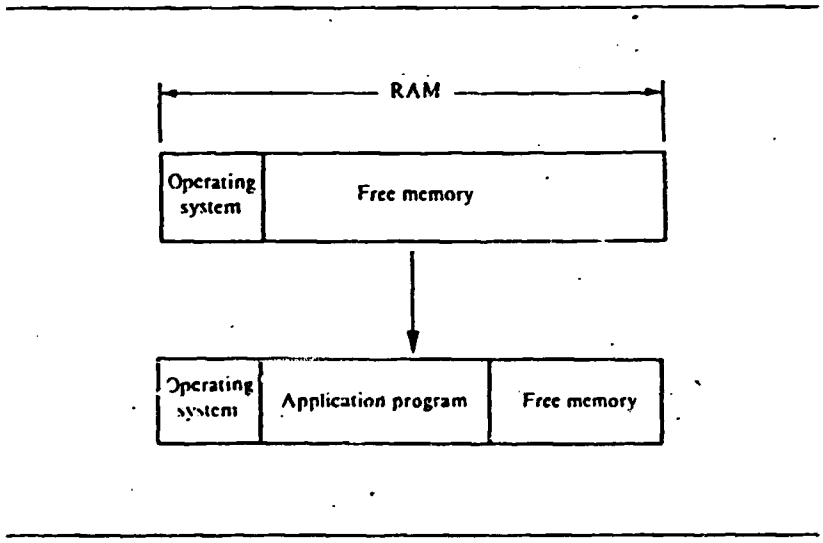

Figure 4. The operating system loading a program into memory

If the command wants to do something that the CPU can't handle by itself /such as printing a character on the screen/, it "calls" on a subprogram, which is like a small part of the operating system, to perform the function. Refer to Figure 5. In this illustration each box in the operation system represents a subprogram. Each box in the application program represents a program step. When you finish with the command, the operating system remains in RAM ready for the next set of instructions.

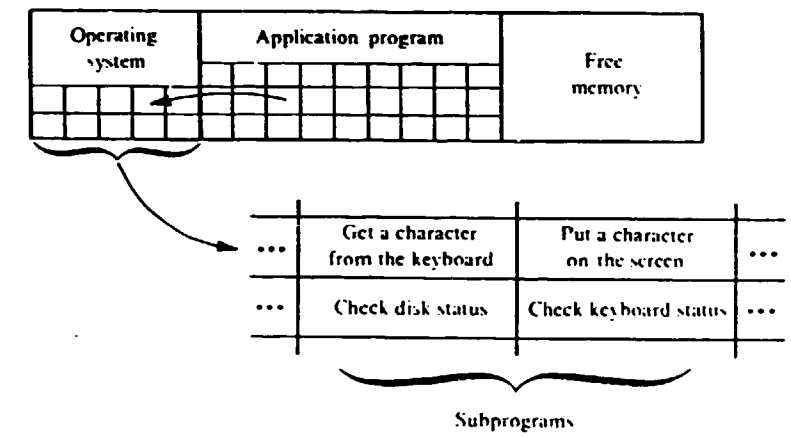

Figure 5. Calling a subprogram of the operating system

SOME DOS COMMANDS

BACKUP Command

Backup [filespec] d: [/S] [/M] [/A] [/D: mm-dd-yy]

Allows you to back up one or more files from fixed disk to diskettes. The optional filespec specifies the files to be backed up. The global filename characters ? and * may be used. If no filename is given, then all files in the directory are backed up.

The destination drive is specified by d:. The /S /subdirectory/ option backs up all subdirectory files as well as those in the specified directory. The /M /modified/ option will back up only those files that have been modified since tha last backup. The /A /add/ option adds the backup files mm-dd-yy /date/ option allo you to back up only those files that have been modified on or after the specified date.

CHANGE DIRECTORY Commands

CHDIR [[d:] path]
CD [[d:] path]

Change the current directory of the specified or default drive to the directory specified by path. the root directory is specified by " \", the parent directory by "..". The CD is valid abbreviation to CHDIR. If no path is specified, the current directory path is displayed.

CHECK DISK Commands

CHKDSK [d:]

Verifies directory and file information on drive d: and produces a status report of disk d: and memory. If no drive d: is specified, verification and disk status apply to the default drive.

CHKDSK [d:] [filename] [/F] [/V]

The /F option allows CHKDSK to correct errors found in the directory of file allocation table. This can free space on disk. The /V option provides progress reports of CHKDSK.

CLEAR SCREEN Command

CLS

Clears the display screen.

COPY Commands

COPY filespec1 [filespec2]

Copies the file specified by filespec1 into the file specified by filespec2. If the destination drive is not specified the default drive is assumed. If the destination filename and extension are not specified, the new file will have the same filename and extension as the source file. Source and destination may also be specified as reserved devices.

COPY filespec1 [filespec2] [/V]

The /V option copies the source file to the destination and verifies that the new file was copied correctly.

COPY filespec1 + filespec2 ... + filespecX [filespecY]

Copies and concatenates /merges/ files filespec1 through filespecX into the specified destination file. If you do not specify a destination filename, the filename in filespec1 will be used.

COPY [/A] [/B] filespec1 [/A] [/B] [filespec2]

The /A option causes COPY to treat the source and/or destination file as an ASCII or text file. The source file with the /A option will

be copied until an ASCII end-of-file /EOF/ character is found. /The EOF character is the CTRL Z or hex 1A character./ COPY will add the EOF character to the end of a destination file when the /A is so specified.

The /B parameter specified on a source file causes the entire file to be copied. With a destination file, the /B specifies that no EOF character is to be appended.

The default is /B when concatenation of files is not specified, /A if concatenation is being performed.

DELETE Command

DEL [filespec]

This command is functionally identical to ERASE. Deletes the file specified by filespec from the designated or default drive and directory. If no filename is given in filespec, then *.* is assumed. The *.* file specifier requests that all files in the appropriate disk and directory be erased. /Any attempt to use the *.* specifier will cause DOS to prompt you for verification of this action before the files are removed./

DIRECTORY Command

DIR [filespec]

Displays a directory listing of names, lengths, and dates of creation of files and subdirectories contained in the specified drive and directory /or the default drive and current directory if none specified/. If the filename or extension is specified, the list will include only those files that match the information given in filespec. Use of the global characters * and ? is permitted. Subdirectories will be marked with the <DIR> identifier in the file size field.

DIR [filespec] [/P] [/W]

The /P option pauses the display of the directory information when the screen is full. To continue with the directory listing after the pause, press any key.

The /W option provides a condensed directory listing with only the file and directory names. Each line of the listing wili contain five names. The /W option is recommended only for systems with 80-column displays.

DISK COPY Command

DISKCOPY [d:] [d:] [/1]

Copies the entire contents of the diskette in the first specified drive to the diskette in the second specified drive. If no drive is specified, the default drive is assumed.

The /1 option limits the disk copying operation to the first side of the diskettes, even if the source disk is double-sided.

ERASE Command

ERASE [filespec]

Erases the file specified by filespec from the designated of default drive and directory. If no filename is given in filespec, then *.* is assumed. The *.* file specifier requests that all files in the appropriate disk and dirctory be erased. /Any attempt to use the *.* specifier will cause DOS to prompt you for verification of this action before the files are removed./

FORMAT Commands

FORMAT [d:]

Initializes the diskette in the specified drive to the proper format necessary to support DOS files. If no drive is specified, then the default drive is assumed. FORMAT prompts you to strike a key to start the process. You must format all new diskettes and fixed disks before they can be used by DOS. /DISKCOPY will format a diskette during the copy process if you have not formatted the diskette with FORMAT./

FORMAT [d:] [/S] [/1] [/8] [/V] [/B]

The /S option causes the operating system files /IBMBIO.COM, IBMODOS.COM, and COMMAND.COM/ to be copied to the diskette being formatted. The /1 option limits the formatting to a single side of the disk and the /8 option sets up the disk in eight-sector-per-track format. /The defaults are double-sided formatting if the drive is a double-sided drive, and nine sectors per track/.

The /V option allows you to give the disk being formatted a volume label, a name for the diskette. This volume label can then be displayed with the DIR and VOL commands.

The /B parameter formats the diskette in eight-sector-per-track format with space allocated for the IBMBIO.COM and IBMDOS.COM system files. The actual files can later be placed on the diskette using the SYS command.

MAKE DIRECTORY Commands

MKDIR [d:] path

MD [d:] path

Create a new subdirectory on the specified disk /or the default disk if none specified/. The new subdirectory is placed in the directory specified in path. A leading "\" in path indicates the root directory. The MKDIR and MD commands are identical.

REMOVE DIRECTORY Commands

RMDIR [d:] path

RD [d:] path

Remove a subdirectory from the specified disk / or from the default disk if none is specified/. The directory must be empty of all files and subdirectories / except the "." and ".." entries/

before it can be removed. The abbreviated command RD may be used in place of RMDIR as desired.

RENAME Command

REN[AME] filespec filename [.ext]

Renames the file specified by filespec to filename [.ext]. The use of the global characters ? and * is permitted. The abbreviation REN may be used in place of RENAME as desired.

RESTORE Command

RESTORE d:[d:] path] [filename] [.ext] [/S] [/P]

Restores one or more files from diskettes to a fixed disk. The files being restored must have been placed on the diskettes by the BACKUP command. The first parameter specifies the backup diskette drive. The second parameter is the fixed disk file you want to restore. The use of the global characters ? and * is permitted.

The /S option causes all of the backed-up files in any subdirectory. The /P option will have RESTORE prompt you for each file before restoring it.

TYPE Command

TYPE filespec

Displays the contents of the file specified by filespec. This command is normally used to display the contents of ASCII text files.