OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

07612

United Nations
Centre for Industrial Development

Original: English

Inter-Regional Symposium on Industrial Project Evaluation

CID/IPE/B.17
Discussion Paper

Prague, Czechoslovakia
11 - 29 October, 1965

FINANCIAL PLANNING OF INDUSTRIAL PROJECTS AND THEIR APPRAISAL

Prepared by: Joel Dean
Graduate School of Business
Columbia University
U.S.A.

for: The Centre for Industrial Development
Department of Economic and Social Affairs
United Nations

65-41314

Investment is the food that nourishes companies, industries, and nations and makes them grow. The industrial investment decisions being made now will determine the framework within which all three will develop in the future. Wise industrial investment encourages rapid and healthy growth of the national economy and its components; unwise investments do just the opposite. Clearly, then, all possible steps should be taken to ensure that industrial investments are made as wisely as possible.

Those steps having to do with evaluating the financial (as opposed to, say, the political or technical) wisdom of an industrial investment project can be called financial planning and evaluation. The object of financial planning and evaluation is to ensure good investments - investments that encourage healthy economic growth. But more specifically, good financial evaluation techniques should allow us to do the following:

1. Evaluate all potential projects so we can choose the most profitable.

2. Determine the economic risks involved in a project so that we can measure them against the benefits expected.

3. Determine the inflow and outflow of capital that the project will involve over a period of years so we know what benefits and/or hardships to expect.

This paper focuses on the financial evaluation of industrial projects, i.e., it examines how an individual industrial project fits into a total capital management program and describes the analysis behind and application of various techniques for projecting how quickly and to what extent a given project will return the capital invested in it. The paper also deals with the overall appraisal of industrial projects. It proposes several criteria to use in this appraisal and outlines standards of minimum acceptability for projects.

FRAMEWORK OF THE FINANCIAL PLAN OF AN INDUSTRIAL PROJECT

An industrial project does not stand alone - it is part of a larger industrial-development program, which in turn is part of an overall capital management program. Before any single project within this overall program can be planned, its setting in the overall program needs to be foreseen. Thus, the company or nation needs a long-range (usually five-year) capital plan. And all industrial projects must be coordinated with this plan. Formation of such a plan is the first step toward avoiding haphazard capital investments.

It is not our task here to go into the design of a long-range capital plan. Different companies and nations need different kinds of plans. However, we can briefly suggest some of the things that such a plan might take into account. Certainly, it should incorporate a forecast of the level of general economic activity, which should include such basic information as population trends, gross national product, price levels, and wage levels. Another important element of such a plan would be an estimate of the stock of human and capital resources required to carry out projected activities five years hence. Still another would be the sum of the replacement capital expenditures that will be necessary. Of course, it is extremely difficult to predict the rate and effects of technological obsolescence or other important factors such as shifts in input sources and markets. But it is possible to estimate the probable total of replacement expenditures that will be required over a given period if no radical changes take place in other areas. Finally, a long-range plan should include consideration of the major projects foreseen into the indefinite future with any information available about their scope and timing.

In devising a long-range plan, it is desirable to use maximum and minimum forecasts in addition to the "best" forecast. Of course, only if everyone engaged in preparing individual forecasts uses these "official" figures as a "given" can projects be compared with each other.

In addition to the long-range capital management plan, the capital management program needs a short-range (usually one-year) capital budget. A short-range capital budget spells out and elaborates the first year of the current long-range plan. It gives a detailed picture of the near-term demand for capital and of sources of funds.

Obviously, the short-range and long-range capital management plans are made up of individual projects. Where do these projects come from?

They do not simply appear on the horizon - the capital investment program that waits for projects to announce themselves is doomed to failure. Good industrial projects result from a creative - and continuing - search for investment opportunities. A plethora of good proposals is essential to the selection of the best possible projects. The only disadvantage of an overabundance of ideas is that the investor may have to pass up some tempting opportunities. On the other hand, a lack of good proposals will probably lead to a waste of resources on projects of low profitability. Thus, creative thinking about and searching for investment ideas should be encouraged in as many ways as possible.

ALTERNATIVE TECHNIQUES OF INDUSTRIAL PROJECT EVALUATION USED BY PRIVATE ENTERPRISE

With long- and short-range capital management plans and an adequate supply of industrial project proposals that seem promising, the problem is to choose the proposal that will be most worthwhile. To do this a yardstick is needed. Here we discuss and evaluate some yardsticks used by private enterprise to determine the profitability of investment in industrial or other kinds of projects. Of course, profitability is not the only criterion of a project's worth. But it is a most relevant measure to use in ranking proposals, even if it is overruled by one of the other criteria we will discuss later.

The three most commonly used yardsticks of profitability are:

1. Payback period (recoupment period)
2. Average return on investment
3. Discounted cash flow method.

Payback Period

The payback period represents the number of years it takes for the gross earnings from a project to recoup to the treasury the total expenditures on that project. It answers the question: "How long before the cash income from this project returns the original costs?" For example, a new machine is installed at a cost of $6 thousand. If the net cash inflow from this machine (generally defined as income after taxes, plus depreciation) is $2 thousand a year, then the payback period for this machine is three years.

Payback is popular as a yardstick for determining investment worth because it is measurable, many people know how to compute it, and it can be explained easily to others who do not know what it is. In addition, payback has some other advantages: it concentrates on the earnings in the near future, which are more valuable and certain than earnings in the distant future. Also, it guards the company's liquidity by preventing investments that tie up funds for long periods.

However, this method has some important disadvantages. A major one is that it often ranks projects incorrectly because it ignores the years <u>after</u> the payback period. If the goal

[redacted]

is simply to get cash back in the treasury quickly, making no investments at all would be the best course. If, however, the goal is to make profits, what matters is how much the investment will yield after the payback period. One project may pay back in two years but produce no earnings after that, while another project with a four-year payback may have a ten-year earnings life. The payback yardstick would rank the first ahead of the second, whereas the second is actually more profitable in the long run.

A second shortcoming of the payback method is that is sets no objective cut-off criterion to separate projects that improve the company's profits from projects that do not. Should the maximum acceptable payback be one year, three years, or ten years? This question must be answered arbitrarily; the payback method gives no way to compare a project's earnings with the cost of the capital invested.

Finally, payback penalizes investments in new products or processes where initial losses are often anticipated, although the long-term earnings from such investments may be very high. Yet such innovations often turn out to be the most profitable investments.

Average Return on Investment

Another yardstick of investment worth is average lifetime return on investment. This is the average income from a project expressed as a percentage of the capital outlay.

Average return on investment does not take into account the time pattern of income - whether the income is evenly distributed over time or is higher in the early or later years. (Using both the payback and average return on investment methods together alleviates this deficiency. But the question still remains as to which is to carry the more weight - payback or profit. How is one investment to be compared with another investment with a quicker payback but a lower profit?)

Furthermore, the average return on investment method has many variants, each usually giving a different rate of return for the same project. This range results from several ambiguities inherent in the method. First, what earnings figure should be used in computing rate of return is not always clear. Should it be earnings before or after depreciation? (The answer to this question often can halve or double the result.) Should it be before or after income taxes? Should the depreciation be on a straight-line basis or a curved-line basis?

Users of the average rate of return method must decide what investment base to employ. Should it be the total investment, or should it be half of the total investment, because this approximates more closely the average amount of capital that is tied up? (The average amount of capital invested is the sum of each year's investment after depreciation divided by the number of years.) Should investment include only the amount "capitalized" on the books, or should it include associated outlays currently written off as expenses?

If the various departments in an organization were free to choose among these and other variants of this lifetime average rate of return method, ranking and comparison of various projects would be meaningless. Of course, top management can arbitrarily specify one method, e.g., earnings after depreciation and taxes, with an investment figure that is half the total amount capitalized. This would reduce the range of possible answers. But it would still sometimes rank projects incorrectly, and it would be of no help at all in determining the cut-off point between desirable and undesirable projects.

Discounted Cash-Flow Method

The most precise yardstick of investment worth is provided by the discounted cash-flow method. Its major characteristic is that it relates the net cash inflow over the whole life of a project to the investment outflow for the project in such a way as to take into account the time pattern of both investment and earnings, the effect of taxes, depreciation allowances, and true capital wastage (i.e., through obsolescence and/or physical deterioration).

The discounted cash-flow method considers each year's earnings separately. It takes into account the fact that early earnings are worth more than late earnings because near-future earnings can be reinvested and continue to earn. It also makes an automatic provision for the return of the dollars invested as well as earnings above the payback amount. A major advantage of the discounted cash-flow method, therefore, is that it correctly takes account of differences among projects in the "time shape" of future earnings. It avoids considering distant earnings just as valuable as earlier ones.

Similarly, this method also makes provision for differences in the timing of outflow of capital. Few investments are made in an instant of time; rather, they are made over a period of time. This has an effect on the true rate of return. A commitment to spend in the future is less burdensome than a commitment to spend the same amount now (for the same reason that current earnings are worth more than future earnings). The discounting formula takes the time span of capital outlays into account correctly.

One variant of the discounted cash-flow method uses the cost of funds to the firm explicitly in the screening of investment proposals. We can view this "cost," which will be described in more detail below, as the interest rate charged to investment projects by the controlling agency, or as the minimum acceptable rate of return on invested funds. It is a "challenge" rate, and those proposals not meeting the challenge would be rejected under this criterion. The computation involves converting cash inflows and outflows associated with the adoption of the project to their "present value," at the specified "cost" of funds. If the present value exceeds zero, the project meets the test, i.e., it generates returns in excess of the minimum required by the firm's financial commitments.

Thus, we say that the discounted cash-flow method has these major advantages:

1. It requires no arbitrary definitions of "investment"

[redacted]

or "earnings," relying solely on the unambiguous measurement of cash flow.

2. It deals consistently with the whole lifetime of earnings, not with only the first few years.

3. It is the only method that takes proper account of the time shape of earnings and investments. It therefore rationally balances cash requirements with profit consequences.

USING THE YARDSTICK TO ESTIMATE INVESTMENT WORTH OF SPECIFIC PROJECTS

Now that we have described alternative yardsticks of investment worth we can turn to the problem of applying the yardstick selected to estimate the investment worth of individual capital proposals. In this process at least four economic dimensions of the project must be measured and appraised. These are:

1. The amount and timing of investment outlay.

2. The amount and timing of the added stream of earnings (net cash receipts).

3. The economic life - i.e., the duration of the earnings stream.

4. The risks, uncertainties, and imponderable benefits associated with the project.

The first three can usually be estimated quantitatively with fair margins that are tolerable for decision purposes. The fourth instead requires a high order of judgment. Let us see how these dimensions are measured.

Measuring Investment The appropriate investment base for evaluation purposes is incremental outlay, which may be less than total outlay. For example, the alternative to a new bridge costing $1.5 million could be modernizing a ferry system, which would cost $0.5 million. The proper investment base for the bridge is not its total cost, $1.5 millions, but its incremental cost, $1.0 millions. However, if the ferry system were to be modernized regardless of whether or not the bridge was built, the ferry system modernization project would not be a true alternative to the bridge, and the incremental outlay for the bridge would be $1.5 millions. On the other hand, the investment amount should include the entire amount of the lifetime added outlays no matter how portions of it are treated in the books. Expensing certain items rather than capitalizing them may produce tax savings that should be reflected in estimating the investment. Any additional investment in working capital or other auxiliary facilities occasioned by the project should be included in the investment amount, as should any future research and promotional expenditures involved. If the proposal calls for transferring any existing facilities, this cost should also be included in the investment amount.

For the purpose of calculating prospective return, the items included in the investment amount should be valued at their economic, rather than their accounting values. For capitalized outlays at the time of the investment decision, these values are identical. For existing facilities, however, there can be a pronounced disparity between them. It is the present value of the earnings opportunities of such transferred facilities that is pertinent; this value is likely to differ from the book value.

If the value of the foregone opportunity of continuing to use the facilities in the next best alternative way is lower than their disposal value, then their disposal value should be used.

The timing of these added investments has an important effect upon the rate of return and it therefore should be reflected in the discounted cash flow computation. After-tax cash flows alone matter.

Measuring Added Earnings. The productivity of the capital tied up in an investment project is determined by the increase in earnings or savings (i.e., net cash receipts) caused by making the investment as opposed to not making it. Only costs and revenues that result directly from adoption of the proposal should be included. However, earnings should be conceived broadly enough to encompass intangible - and often unquantifiable - benefits. When these have to be omitted from the formal earnings estimates, they should be noted for inclusion in any subsequent appraisal of the project. As with investments, the timing of added earnings is significant and should be reflected in the computation.

Estimating Economic Life. The economic life of a project is that period during which economic benefits continue to result from it. It may be brought to an end by physical deterioration, by obsolescence, or by the drying up of the source of earnings. Economic life is often the most difficult dimension of project value to quantify, but the problem cannot be avoided. While some estimate is better than none, the depreciable life forecasted for bookkeeping or tax purposes is not always the best available forecast of economic life.

Appraising Risks, Uncertainties, and Imponderable Benefits. Appraising the risks, uncertainties, and imponderable benefits associated with a project requires a high order of judgment. These appraisals should result from the collective wisdom of those best qualified to make them. Usually, only the differences in amount of risk among projects need be considered, since the company's cost of capital reflects over-all risks of investment. Only when an investment alters the general character of the company's operations significantly will the risk reflected in the company's cost of capital be revalued in the market.

In the process of measuring the probable return on each project, the company may be successful in adjusting for the probable range of earnings and the timing of earnings. If so, only the dispersion of possible outcomes constitutes differential risk. For example, a labor-saving device would probably have a lower dispersion of outcomes than a new product, and the chances of big, improbable gains or losses would be smaller than for a new product. Though determining the dispersion of probable results is difficult, some headway occasionally can be made by a necessarily arbitrary risk-ranking of candidate projects or categories of projects.

Most projects have some added benefits over and above those that are measurable. However, care must be taken not to give excessive weight to these imponderables. When a low-rate of-return project is preferred to a high one on the grounds of unmeasurable benefits, the burden of proof clearly rests on the imponderables.

Some important principles of measurement emerge from

[redacted]

this discussion of measurement:

1. Only added investment and added earnings connected with the project are relevant. No revenues that will be the same whether the proposal is accepted or rejected should be included in estimated earnings, and a like rule should be applied to investment calculations.

2. After-tax cash flows or their equivalents alone are significant for measuring capital productivity. Book costs (e.g., depreciation on existing facilities) are confusing and immaterial.

3. Timing of investments and earnings is significant and should affect the rate of return calculations.

4. Usually only differences in amount of risk between proposals need be considered. The dispersion of possible outcomes is a good indicator of these differences.

A final note: It should always be remembered that there is at least one alternative to every proposed capital expenditure. It may, of course, be so catastrophic that refined measurement is unnecessary to reject it. Often, however, one or more alternatives appear of almost equal worth. In this case it is important to evaluate each carefully before a decision is made.

CRITERIA OF INDUSTRIAL PROJECT EVALUATION

Ranking a group of project proposals according to the best available determinations of the return on investment that can be expected from each (or according to any other measure) does not completely solve the problem of making investment decisions.

The proposal that ranks highest may still be unacceptable. To determine which if any proposals are acceptable, the potential investor needs a comprehensive list of criteria for investment projects. Each proposal must then be measured against these criteria.

Clearly, criteria can be of many different types depending on the investor's needs, desires, and situation. For example, profitability can give way to a wish to enhance private or national prestige or a need to provide people with work in an underdeveloped area. Investors with large amounts of funds readily available can take greater risks than can those with limited resources. The goals governing public agencies' use of funds are different from those pursued by private enterprise.

The important general rule is that any investor considering industrial investment projects - whether large or small, public or private - needs to state clearly and apply consistently and rigorously the investment criteria that fit its particular situation. Investment criteria of course are inseparable from the long-range plan discussed above; the elements that go into this plan and the policies that emerge from it determine these criteria, which should be designed to ensure attainment of the plan's objectives.

A convenient way to attack this phase of investment-proposal evaluation is to set objective standards of minimum acceptability. With such standards unacceptable proposals can be screened out automatically, and if all proposed investment projects should prove unacceptable a search can be begun immediately for new proposals.

[redacted]

A company's cost of capital is the amount the company has to pay for money. It reflects the financial market's appraisal of the company's risks and profit outlook as compared to alternative opportunities open to investors. If the company invests in projects with rates of return that are lower than its cost of capital, its financial position is worsened, the market loses confidence in the company, and ultimately it becomes more difficult and expensive for the company to obtain capital. The company's cost of capital is thus a good minimum standard to use in evaluating projects.

Since cost of capital is determined to be used as a standard for future investment decisions, what is relevant is not what money costs now, but what it will cost in the future. Thus, cost of capital estimates are made on the basis of past experience and present actualities but must be projected into the long-run future. In measuring the company's total cost of capital, it is necessary to examine the cost of each source of capital available to the company - e.g., through borrowing money, issuing stock, plowing back cash earnings, selling assets. The total cost of capital is a combination of the costs of capital from all sources open to the company.

This suggestion of what cost of capital means to the individual firm and how it is measured can in principle be broadened to a consideration of the cost of capital to the national economy and to society.

There are three alternative concepts of the cost of capital to the nation. Unfortunately, they produce distressingly different estimates of this figure.

The first concept is that, to the government, capital is a free good. Those holding this belief cite three reasons for it. One is that the government can create unlimited quantities of money. However, creating money does not increase the nation's real resources, it merely reallocates them and, as spending power grows, causes inflation. Thus, capital obtained in this way is paid for by the instability and slow growth associated with inflation.

Another reason is that the government's power to tax is unlimited. Excess taxation, however, destroys the taxable base of real wealth and income. Capital obtained through increased taxation has a hidden cost in the form of a decaying growth rate, impaired incentives, and misallocation of resources.

A third reason for claiming that capital costs the government nothing is that some governments can get capital from more affluent nations in the form of gifts and loans that will never be repaid. To the extent that these gifts and loans require no use of national resources that would be otherwise productively employed, this capital is free. Often, however, a condition for these gifts and loans is the costly diversion of the nation's resources from more profitable uses. In this case capital is obtained at the cost of crucial, scarce national resources, e.g., skilled labor and supervision.

A second concept of the cost of capital to a nation is the government borrowing rate, which is the visible market cost of borrowed capital. Unlike the market cost of corporate debt capital, which is determined by the market forces of supply and demand, these rates are manipulable and arbitrary. Often, the government rates conceal a subsidy by not reflecting the degree of risk associated with the borrowing.

A third concept is that the cost of capital to a government is the sum of the cost of capital to all the corporations constituting the private enterprise sector of society in that nation. The reasoning behind this view is that funds must ultimately come from the private enterprise sector, and the alternative is to have them employed there rather than by government capital formation.

Like all criteria, the cost of capital standard can be bypassed under certain conditions. Whenever it is, however, there should be ample proof that the investment project in question is justified by other important contributions. Such proof should be required of public as well as private investments, since both governments and private industry can only stand to gain by planning and appraising investment projects with as much care and sophistication as present methods permit.

C-677

78.11.15