NATIONAL COUNCIL OF CONCESSIONS

GUIDE FOR PREPARING A FINANCIAL STUDY FOR PRIVATE INITIATIVE PROJECTS

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PRIVATE INITIATIVE PROGRAM

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Purpose of the Guide

The purpose of this document is to provide a basic guide for the preparation of financial analysis for anyone submitting, processing and developing private initiative proposals.

Unlike an instructive manual, which leads the reader through a series of steps necessary to obtain a defined product, this guide aims to serve as a source of information to build sufficient judgment and to help proponents and the administration, using the same theoretical basis when defining the scope of the financial studies to be carried out.

Due to the great variability in scope and magnitude of the different projects that can be presented with the private initiative tool, in some cases it may be necessary to go much further than what is outlined in this guide. However, the points included in this document should be considered the minimum information necessary for the Administration to analyze and justify its interest in a public works concession project that has been conceptualized and presented by a private interested party.

In this way, this guide aims to define basic cash flows concepts, including the different types of flows necessary for an appropriate analysis for the Administration, as well as to discuss project evaluation criteria commonly used by public institutions: IRR and NPV.

A point usually overlooked when carrying out financial analysis of projects, which is of primary relevance in the case of concession projects, is the definition of the discount rate. This paper briefly discusses some considerations that should be taken into account in all cases to properly define this rate.

It is important to do all this considering the financial study as part of an iterative project development process. Therefore, the guide is introduced with a basic discussion of the relationship between this study and other studies such as the technical study, market study, environmental assessment, organizational-legal assessment and risk analysis.

The Financial Study as Part of a Process

Private initiative projects are comprised of four stages: concept, application, proposal and concession.

The concept stage can be systematically involves searching for new benefits, a process of permanently searching for new project ideas. To this end, the private interested party tries to identify problems that can be solved and business opportunities that can be exploited. Different ways of solving a problem or seizing an opportunity become project concepts. For example, when a port is having problems due to lack of capacity, projects are developed to expand facilities or build a new port to replace or complement the old one. It is also necessary to analyze whether maintaining the current situation is better than the alternatives identified; in other words, if the projects identified prove to be better than the current condition. Likewise, business opportunities may be leveraged by providing new public services or improving the quality of existing services. Hence it can be said that the concept of a project, rather than a lucky occurrence of an investor, generally entails an assessment that identifies different solution ideas. Although this stage is not part of the stages described by the Private Initiative Regulations, we should highlight the importance of the concept of the idea in terms of the future development process.

At the beginning of the application phase, various preliminary feasibility studies are performed, commonly known as the profile and the pre-feasibility. These serve as a basis for the preparation of the application document that will be delivered to the Granting Administration. All these studies must be carried out in four dimensions: technical, legal, environmental and financial. The remainder of this text focuses only on the preparation of financial studies, without neglecting the relationship of the other components of the studies on financial assessment.

The initial study, prior to the preparation of the application document, is called "profile," and it is prepared based on existing information, common judgment and opinions given by experience. In monetary terms, only very global estimates are included for investments, costs or income, without going into field research.

In this analysis, it is essential to make some preliminary considerations about the situation "without the project," i.e. trying to project what will happen in the future if the project is not started before deciding whether or not to implement it. For example, the idea of building a public work could be very attractive if, at a given moment, a great demand for the public services that could be offered in it is detected. However, it is possible that, in investigating the future demand, it may be found that it is better to abandon the idea before proceeding with such an initiative.

In the profile study, rather than calculating the profitability of the project, the interested party must determine whether there is any reason to justify abandoning an idea before resources are allocated to prepare the application, which may require significant amounts

of resources in some cases. At this level, projects most often selected are those most attractive for solving a problem or taking advantage of an opportunity.

The next level is a usually called "pre-feasibility" study, which will support the application document that will be submitted to the Granting Administration for evaluation. This study analyzes information from secondary sources to define, with some approximation, the main variables related to the market, technical construction alternatives and the financial capacity of investors, among others. In general terms, we estimate potential investments, operating costs and income that the project will demand and generate.

Fundamentally, this stage is characterized by discarding solutions with more elements of judgment. In order to do this, the aspects preliminarily identified as critical in the profile study are analyzed further, although it is still research based on secondary, non-demonstrative information. For example, physical work investment calculations can be done with average costs of construction per square meter, or by determining the growth of service demands according to population growth rate. Both, however, do not represent the best way of measuring the variables to be quantified, although they are sufficient for the purposes at this stage. In any case, after an alternative-selection process, the application document includes only options that have been determined viable with the information collected up to this moment.

As figures are an approximation, it advisable to measure how the profitability changes when variables change.

The outcome of this study is the application document, which allows the Administration to determine whether it accepts it and, thus, continues with subsequent studies or, on the contrary, whether it rejects it, which implies discarding or delaying the project until certain minimum conditions have been fulfilled.

The most comprehensive study, referred to as the "feasibility study," is undertaken during the proposal and based on precise background information collected mainly through primary information sources. Qualitative variables are minimal compared to previous studies. Financial and economic variables should be calculated in a sufficiently demonstrative manner to justify the valuation of the different items and to support the bid specifications.

This stage is the final step of the study before preparing publishing the bid specifications. Therefore, the responsibilities of the proponent and the Administration include, beyond the simple feasibility study, ensuring the optimization of every aspect that depends on an economic decision, such as size, technology or the location of the project, among others.

The financial study of projects, however detailed it is, distinguishes between two major stages: formulation and preparation and evaluation. The first stage aims to define all the

characteristics that can impact cash inflows and outflows of the project and to calculate its magnitude. The second stage, with very defined methodologies, seeks to determine the profitability of the project investment.

In many cases, evaluations will be required during the project formulation stage. The most common is to conduct studies at the profile level to select the combination of factors that gives the final configuration to the project, although in some cases an in-depth study is recommended for one or more of the issues to be solved during a project's formulation.

The formulation and preparation stage has two sub-stages: collecting information (or creating information), and systematizing the available information in monetary terms. The systematization is incorporated in building a projected cash flow, which serves as a basis to evaluate the project. This cash flow will have a different scope at the end of the application and at the end of the proposal, because of the different information available in each of these stages. However, it should be possible to build a cash flow at both these evaluation moments in private initiative projects.
Although commonly referred to as "cash flow," it is possible to distinguish three different types, depending on the purpose of the evaluation. Thus, there is a cash flow to measure the profitability of the entire investment, regardless of its sources of financing; another to measure the profitability only of the resources provided by the investor; and another to measure the payment capacity or the capacity, regardless of the profitability that the project may have, to fulfill the obligations imposed by the conditions of the debt and the operation.

On the other hand, the evaluation stage is comprised of three sub-stages: measuring the project's profitability, analysis of the qualitative variables and awareness-raising about the project.

Profitability is calculated on the basis of a cash flow projected on a series of assumptions. Qualitative analysis complements the evaluation carried out with all the non-quantifiable elements that could influence the decision to carry out the project or not. Special attention should be given to identifying the weaker aspects of the evaluated project. Thus, the last sub-stage focuses on raising awareness of only those aspects that could lead to major changes in the calculated profitability, given increased probabilities of a different behavior than expected.

The complete analysis of a project requires, at least, the following complementary studies: market, technical, organizational-legal, risk, environmental and financial. While the first five fundamentally provide economic information on costs and benefits, the latter, in addition to generating information, builds cash flows and evaluates the project.

Below is a brief discussion of the relationship between each of these studies and the financial analysis of a private initiative project.

Project Technical Study

As part of the financial viability analysis of a project, the technical study aims to provide information to quantify the amount of investments and operating costs relevant to this area.

Technically, there are several ways of solving one same problem, and these can be prioritized according to their degree of financial perfection. In general, it is estimated that the most modern procedures and technologies should be applied, although this may be a technically optimal solution, but not financially sound.
One of the outcomes of this study, is to define the solution that optimizes the use of available resources for the provision of the service associated with the project. It provides information on capital needs, labor and material resources (including land), both for the construction and start-up and for the subsequent operation of the project.

In particular, the technical study determines the equipment requirements for the operation and the amount of corresponding investment. The analysis of technical characteristics and specifications of the equipment helps design the layout of the plant, which in turn allows understanding the physical space needs for normal operations, considering the standards and principles associated with the service provided.

By analyzing this background information, it is possible to quantify the manpower needs by specialization and to assign a level of compensation to calculate operating costs. In the same way, the costs of maintenance and repairs, as well as the replacement of equipment, must be deducted. The description of the construction and operating process also makes it possible to know the inputs that the process will require.

Defining the size of the project is fundamental to determine the investments and costs derived from the technical study. Typically, during this stage of the study, a specific project size and operation alternative can be chosen. However, when there are doubts between two or more possibilities, it is advisable not to make a decision at the application stage. In this case, different technical alternatives must be studied, thus postponing the decision until the Proposition stage, if necessary.

This seems more obvious when considering other variables of effects interrelated with previous ones, such as location. When this is not predetermined, it must be chosen through an integral process of analysis that allows its compatibility, among other factors, with size. The effects of size on the location decision are more complex than it seems, since they incorporate technical restrictions to an economic analysis already strongly influenced by transportation costs, the proximity of the consumer market, availability and relative price of inputs, expectations of future variations in the current situation, and others. All of this must be analyzed in combination with the determinants of size, such as current and expected demand, financial capacity, constraints on the technological process, and so on.

Market Study

One of the most critical factors in the financial study of projects involves determining the market, which defines demand and operating income, as well as costs and implicit investments.

The market study is more than analyzing and determining the supply and demand or the prices of the project. There are elements, which may sometimes be considered secondary, that can influence the project's market. The introduction of an electronic toll system on a highway can positively influence vehicle flows. However, this technology involves a series of additional factors that must be considered, such as the possibility of having preferential rates, the cost of distribution of electronic readers, etc. Seasonal variations in the price of the service; image-building investments; conditioning service sale premises according to the requirements observed in the study of potential clients; and credit policies recommended in the study may all constitute variables relevant to the outcome of the evaluation. Methodologically speaking, four aspects should be analyzed:

a) The consumer and the market and project demands, both current and projected.

b) The competition and the market and project supplies, both current and projected.

c) Marketing of the product or service generated by the project.

d) Suppliers and the availability and price of inputs, current and projected.

Consumer analysis aims to characterize current and potential consumers, identifying their preferences, consumption habits, and motivations to create a profile on which to base the demand analysis. The demand analysis aims to quantify the volume of services that the consumer could demand from the project. Demand is linked to different price levels and service provision conditions, among other factors, and is projected over time, clearly differentiating the desired demand from the expected demand.

The main difficulty of this is to define the projection of global demand and the portion that will be captured by the project. However, there are various techniques and procedures to approximate this, most of the time reliably.

Recalling that there may be competition from other projects or operators, both national and international, studying the competition is fundamental for several reasons. For example, the business strategy defined for the project cannot be indifferent to it. It is necessary to acknowledge competing projects to guarantee that the new project will help improve market conditions. This also supports potential service provision policies to be implemented by the project in order to improve the existing and future market. In some cases, studying the competition may influence project location or size, which in turn has a strong influence on the project's financial variables.

The analysis of service commercialization and service delivery policies is perhaps the most difficult factor to determine at the application stage, since the simulation of their strategies has the problem of estimating reactions and variations of the medium during project operation. However, this should not be a reason to avoid such an analysis, and the best efforts should be made to consider these factors at the application stage, especially for the purposes of defining the scope of analysis at the proposition stage.

Many decisions will be made regarding the project service delivery strategy, which should be based on the results of the analyzes indicated in previous paragraphs. Decisions made here have a direct impact on project profitability due to the economic consequences manifested in income and expenses.

The supplier market can become a determining factor in the success or failure of a project. Hence the need to study whether there is availability of the required inputs and what price should be paid to ensure their supply. In some cases, the information obtained from suppliers may even influence the selection of the project location.

Organizational and Legal Study

One of the aspects that are least taken into account in project studies refers to the executive activity of project management: organization, administrative procedures and legal aspects.

For each project, it is possible to define the organizational structure that best suits the requirements of its subsequent operation. Understanding this structure is essential to define qualified management staffing needs and, therefore, to more precisely estimate the indirect costs of the executive workforce.
A very simple analysis would be enough to evidence the influence of administrative procedures on project investments and costs. Accounting and financial information, planning and budget systems and procedures, personnel, procurement, credit, collections and many more are associated with specific operating costs. Although these amounts in many cases need not be broken down at the application stage, it is important to estimate the overall contribution of these activities in the project operation costs. All these estimates should be expanded during the proposal stage, in order to best determine the influence of these factors on the financial analysis of the project.

The preliminary estimate of required organization for project construction and operation allows defining the physical space needs for offices, corridors, parking, gardens, and access roads,

which has an impact on the cost of land acquisition. In some projects, this may involve expropriations, which will need to be identified and optimized as soon as possible.

None of these considerations can be left to chance. Other cost elements are derived from their analysis, which could mean a project is not as cost-effective as preliminary estimates would have led to believe.

The legal study is as important as the above. Although it does not respond to internal project decisions, such as the organization, it indirectly influences them and, consequently, the quantification of disbursements.

Legal aspects can restrict location and force higher transportation costs. One of the most direct effects of legal and regulatory factors refers to tax issues. There are usually provisions that affect projects differently, depending on the service associated with them.

This is manifested in the granting of permits and patents, differentiated tariff rates for different types of raw materials or finished products, or even in the incorporation of the company that will carry out the project, which has different tax requirements depending on which type of organization is selected.

Another important point is determining the influence of applicable legal regulations on the tariff schemes to be used. Likewise, it is possible to identify a series of other economic and financial effects that may be linked to legal variables.

Risk Analysis

Certainty over the occurrence of events considered during project preparation is not likely. Therefore, it is necessary to consider the risk involved in executing the project. Many methods have been developed to include the risk and uncertainty of the occurrence of the project's expected benefits. Some directly incorporate the effect of risk into project data, while others determine the maximum variability that some of the variables could experience in order for the project to remain profitable. This last criterion refers to the sensitivity analysis.

To evaluate the impact of this type of analysis, the Private Initiative Project Risk Analysis Guide has been developed, which is complementary to this Guide. However, it is necessary to include the results of such analysis monetarily in the financial study, to provide more information for the Administration to make the decision to go ahead with the project and define the scope of the proposal stage.

Environmental Impact Study

In addition to complying with the requirements of National Environmental Technical Secretariat (SETENA) during the application and proposal stages, the environmental impact study should provide information that will be included as part of the project financial and economic analysis. The proponent of private initiative projects must increasingly be concerned with the complete production cycle a project will generate, determining the environmental impact that the service

will produce, as well as the suppliers of the inputs and the distribution system of the service, if applicable.

It is also possible to anticipate higher future costs derived from evolving environmental variables. For example, if the project belongs to a sector with poor environmental image, which would lead us to expect higher costs and less competitiveness due to compliance with stricter environmental standards in the future; determining the best location in a sector of increasing ecological or recreational value that might have to be transferred in the medium or long term given community pressures; participation in a sector where consumers are increasingly asking for more environmental demands.

While it is possible to say that development and negative environmental effects coexist simultaneously, we can also recognize that their timely prevention and control will allow sustainable economic growth, which should not be interpreted as absolute conservation of the environment preventing the identification of investment projects that generate benefits beyond the environmental costs assumed, given the need for progress and, ultimately, to improve the quality of life of the population.

The environmental impact study as part of the economic assessment of a project has not been sufficiently addressed, although substantial progress has been made in recent times. There are three of environmental impact studies: qualitative, numerical and quantitative.

Qualitative methods identify, analyze and explain the positive and negative impacts that could be caused in the environment with the implementation of the project. Both the hierarchization and the valuation of these effects are commonly based on subjective criteria, so their use is associated with feasibility studies performed at the profile stage, prior to preparing the application.

Numerical qualitative methods relate weighting factors on scales of numerical values to environmental variables. One of these methods, by Brown and Gibson[1], points out that in order to determine the location of a project, it is necessary to consider the combination of potential quantifying factors (the cost of a toxic emission control system, for example) with subjective factors such as the satisfaction of a clean landscape), assigning them a rating relative to each of these variables.

Quantitative methods determine both the costs associated with total or partial mitigation measures and the benefits of avoided damages, including both effects within the cash flows of the project under evaluation. According to these methods, environmental damage mitigation measures are advanced to the point where the marginal value of avoided damage equals the marginal cost of damage control. From an economic standpoint, these methods seek to minimize the total cost of the project, for which a certain level of residual environmental damage -which in many cases is not permanent- is allowable.

When a private initiative project is evaluated socially, what is sought is to measure the costs it

[1] See chapter 9, SAPAG CHAIN, "Project Preparation and Evaluation."

causes and the benefits that society receives as a whole for the realization of a project. One of the main differences it has regarding private evaluation is that it considers the externalities, both positive and negative, that the investment generates. While the positive externalities correspond to the benefits generated by a project and perceived by economic agents other than those who pay for the goods and services offered by the project, negative externalities are the costs assumed by members of society other than those who benefit from such goods and services.

Although many externalities are not economic in nature, they can affect the quality of life of the community. For example, pollution of a lake whose surroundings were used for recreational purposes. On the other hand, non-economic externalities are linked to a cost when seeking to remedy the damage caused.
When measuring the social profitability of a project, the evaluator must try to quantify the environmental costs and benefits that the investment will cause, always in accordance with the scope of the project stage, or proposal. In order to do this, it is possible to use different methods to incorporate the monetary factor into the environmental effect, such as contingent valuation methods, avoided costs or hedonic prices[2].

The contingent valuation method seeks to determine people's willingness to pay for the expected benefits of the project. For example, through the right to use exclusive roads that make traffic more expedited or to see the waters of a lake decontaminated to recover a recreational space. Many variables determine this willingness to pay. For example, the level of income of the population or the proximity and capacity of access to the improved areas.

The avoided cost method considers that the cost associated with an externality must be assumed by the project that causes it. For this, it incorporates the expense of remedying the damage caused as part of the costs or the costs avoided by the investment for the rest of the community as part of the benefits.

The hedonic price method seeks to determine all attributes of an asset that could explain the price that people are willing to pay for it. That is, it considers that price reflects, among other things, the quality of the environment that will be affected by the project. For example, when paving a dirt road, the price of houses on that street increases substantially, in relative terms, than those houses where the street is repaved, even though the cost of repaving may be higher than that of paving.

From the perspective of private project evaluation, it is important to measure the costs and benefits that the investor will most likely face. If the project must face the possibility of future disbursements to compensate for damages caused, this value should be incorporated into the project.

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[2] A detailed discussion on the methods of environmental assessment is found in Diego Azqueta "Economic valuation of environmental quality". McGraw-Hill, Madrid, 1994, pp 75-191.

If there are specific rules that restrict the formulation of the project, such as an impediment of erecting a building to rent parking lots due to the traffic impact it causes on the street, the applicant should investigate the existence of other options. If the construction of an 800-car parking lot is justified by the demand, from the point of view of private profitability, and there is a restriction on the size due to the negative road impact this project will cause, it shall be necessary to consider the suitability of a smaller parking lot, with exits to different streets, but always within standards, or the change of location to another place.

Among other direct environmental effects on the financial analysis, the evaluation should include costs to meet gas-emission control or water pollution standards; costs to dispose of, recycle or biodegrade solid waste that cannot be deposited in places under control and authorized for such purposes; to access raw materials that comply with environmental regulations regarding packaging or waste transportation; to comply with environmental standards related to marketing the project service, and others.

Financial Study

The final stage of the financial viability analysis of a project is the financial study. The objectives of this stage are to organize and systematize the monetary information provided by the previous stages; to prepare the analytical tables and additional data for the evaluation of the project; and to evaluate the background information to determine profitability.

The systematization of financial information consists of identifying and ordering all investment items, costs and revenues that can be deduced from previous studies. However, because not all the information necessary for the evaluation has been provided, the elements that the financial study itself must provide should be defined at this stage. The classic case is the calculation of the amount to be invested in working capital or the project salvage value, if any.

Project investments can be classified, as appropriate, into land, physical works, equipment and furniture, working capital, start-up and others. Since it may be necessary to incur investments during the project operational life for extensions of buildings, replacement of equipment or additions of working capital, an investment and reinvestment scheme must be presented, which can be created in two separate reports, corresponding to the stage prior to start-up and during operation. Information on the residual value of investments should also be provided.

Operating income is deducted from the projected price and demand information, calculated in the market study, the conditions of service provision, estimates of the sale of waste and calculation of revenue from the sale of equipment which is to be replaced during the evaluation period as per background information derived from the technical studies (for equipment), organizational (for furniture) and market (for the equipment associated with the provision of the service).

Operating costs are calculated with information from virtually all previous studies. There is, however, a cost item that should calculated at this stage: income tax, because this disbursement is a direct consequence of the project's accounting results, which may be different from the actual

results obtained from projections of the company accounting statements.

The evaluation of the project is done on the estimation of the cash flow of the costs and benefits. Project profitability *per se* can be different from investor profitability, given the influence of financing. Therefore, a special analysis is later applied to the subject. The result of the evaluation is measured by different criteria that are, rather than optional, complementary to each other.

Evaluating a project on a fixed term can lead to erroneous conclusions, especially in the case of Public Works Concessions. It is often adopted as a rule that a project should be evaluated after a certain number of years. However, financial analysis should preliminarily support the proposed concession term for the project. It is important to define the sensitivity of the project to the operation start date, since the profitability of a project may be higher or lower if its implementation is postponed for some periods. Not all profitable projects must be implemented immediately, even if the necessary resources exist, if it is shown that their profitability is maximized by delaying their initiation.

Following this same rationale, we can conclude that a project is more profitable if it is abandoned before the date scheduled in the evaluation. In other words, just as the postponement of start-up should be analyzed, abandonment before the planned completion should also be considered. Even if the project has been evaluated, approved and implemented, there may be an investment alternative that recommends abandoning the investment in progress. If such conditions can be identified during the application, it will be necessary to expressly mention them.

Finally, a variable that complements the financial information that will be delivered to the Administration is related to financing. When the effect of financing is included in a cash flow, regardless of the proposed financing modality, the profitability of the project is no longer measured, and the profitability of the capital invested in the project is determined, which may be substantially different from the project profitability. Given the need to evaluate the project's financing perspectives, the Administration must consider both types of profitability to make a decision on the project during the application stage.

Building Cash Flows

The projection of cash flow is one of the most important elements of a project's studies, since this evaluation is based on the results that determine it. The basic information to carry out this projection is included in the market, technical and organizational-legal studies, as well as in the calculation of environmental and social costs and benefits. When projecting cash flow, it is necessary to incorporate additional information related, mainly, to the tax effects of depreciation, amortization of nominal assets, residual value, profits and losses. It is possible to incorporate risk analysis results to account for the effects of the uncertainty to which the project is subject.

The most common problem associated with building a cash flow is that different flows have different purposes: one measures project profitability, another measures profitability of own resources and a third one measures payment capacity considering loans that helped finance them. Differences also occur depending on how the project is financed, and this is of greater

importance for the case of structured debt (Project Finance).

Moreover, the unique features of the Concessions scheme entail other accounting, legal and financial considerations to cash flow construction, compared to other types of infrastructure projects.

Cash Flow Elements

Any project's cash flow is made up of four basic elements: a) initial cash outflows, b) operating income and expenses, c) the time at which these revenues and expenses occur, and d) the junk value or salvage value of the project.

The initial outflows are the total of initial investment required to start up the project. Although working capital does not imply a full disbursement before starting operations, it is also considered an expenditure at moment zero, since it must be available for the project manager to use it. In some cases, working capital investment can occur over several periods. If this is the case, only the part that must actually be available prior to start-up will be taken into account within the initial expenditures.

Operating income and expenditure constitute all cash inflows and outflows. It is usual to find income and expense calculations based on project study accounting flows, which, due to their nature as caused or accrued. They do not necessarily occur simultaneously with the actual flows.

The difference between accruals or actual income is necessary, as the moment when income and expenses are actually made is decisive for the evaluation of the project. However, this difference becomes minimal when working with annual flows, since accounts accrued in a month are generally effective within the annual period.

Cash flows are expressed in moments. Moment zero reflects all expenditures before the beginning of the project. The evaluation horizon depends on each project's characteristics. In some cases, it is possible to identify an expected service life for the project, thus defining the horizon of project analysis. In some cases, this horizon is defined by the moment when the project salvage value reaches zero; in other cases, it is when the works require a considerable investment and call for a new concession. In general, the period of analysis should be thoroughly justified, recognizing the relationship between the analysis period and the concession term.

The costs that make up the cash flow are derived from the market, technical, organizational-legal, and environmental studies discussed above. Each of the studies defines the basic resources necessary for the optimal operation in each area, quantifying the costs of use.

One outflow not included in other studies, which should be included in the project cash flow is income tax.

In order to calculate it, certain accounting expenses that do not constitute cash movements should be considered, but which allow reducing the accounting profit on which the corresponding tax must be paid. These expenses, known as non-disbursable expenses, consist of

depreciations of fixed assets, amortization of intangible assets and the book value of the assets sold.
Since the disbursement originates when the asset is acquired, depreciation expenses do not imply a cash expense, but an accounting expense to offset, through a tax payment reduction, the loss of value of the assets given their use. The greater the expense for depreciation, the smaller the taxable income and, therefore, also the tax payable over the project profits.

Although there are many methods to calculate depreciation, feasibility studies generally accept the convention that it is sufficient to apply the straight-line method without residual value; that is, the entire asset is assumed to depreciate in a similar proportion each year.

This is justified because, since depreciation is not a cash outflow, it only affects the profitability of the project because of its indirect effects on taxes. When depreciating all the asset, by any method, we have the same tax savings, and the only difference is the moment when it occurs. Since the effect is so marginal, we choose the straight-line method which, in addition to being easier to apply, provides the most conservative scenario.

We should highlight that what concerns project preparers and evaluators is to incorporate all the disbursements, regardless of any ordering or classification of costs that allows to verify their inclusion.

A usual cost classification is grouped by expense object, in construction and equipment costs, operating expenses, financial costs and others.

Construction and equipment costs can be direct or indirect. Direct costs are comprised of direct materials and direct labor, which must include salaries, social benefits, indemnities, gratuities and other disbursements related to a salary or wage. Indirect costs are comprised of indirect labor (administrative staff, drivers, repair and maintenance personnel, cleaning staff, security guards); indirect materials (spare parts, fuels and lubricants, cleaning supplies); and indirect costs such as energy (electricity, gas,

steam), communications (telephone, radio, telex, intercoms), insurance, leases, depreciations and the like.

Operating expenses may be selling expenses (incurred for the sale of public services offered) or overheads and administrative expenses. Selling expenses are comprised of labor expenses (such as salaries, social insurance, gratuities and others), sales commissions and collections, advertising, packaging, transport and storage (for example, in the case of mass sale of electronic toll systems on a highway). Overheads and administrative expenses consist of working expenses, representation expenses, insurance, rent, office supplies and materials, depreciation of administrative buildings and office equipment, taxes and others. Legal representation expenses are often an important factor in public works concession projects.

Financial expenses, which can be analyzed in different aspects, are interest expenses for loans obtained, as well as all commissions that must be disbursed to acquire financing.

The item "Other Expenses" includes estimates of other amounts that do not correspond to any of the above descriptions, as well as the contingency reserve, which usually corresponds to a percentage over the total. If the risk analysis defines a contingency amount for the execution of the risk-response plans, this amount may be included in this item.

Structure of a Cash Flow

Cash flows can be based on a general structure[3], which applies to any purpose of the project study. The order in the table below is for a project seeking to measure the return on investment.

+	Taxable income
-	Taxable expenditure
-	Non-disbursable expenses
=	Profit before tax
-	Tax
=	Profit after tax
+	Adjustments due to non-disbursable expenses
-	Non-taxable expenditure
+	Non-taxable benefits
=	Cash flow

The general model is proposed by Nassir Sapag in *"Project Evaluation Criteria"* Madrid: McGraw-Hill, 1993.

[3]

Taxable income and expenditure refers to all those that increase or decrease the concessionaire's accounting income. *Non-disbursable expenses* are expenses that are deductible for tax purposes, but do not cause cash outflows, such as depreciation, amortization of intangible assets or the book value of an asset that is sold. As they are not cash outflows, they are subtracted first to take advantage of their tax discount and added under the item *"Adjustment for non-disbursable expenses."*

This way, only the tax effect is included. *Non-taxable expenditure* refers to investments, since they do not increase or decrease the accounting income of the company by the mere fact of acquiring them. It is usually only a change in assets (equipment for cash) or a simultaneous increase of an asset with a liability (equipment and borrowing). *Non-taxable benefits* are the project's salvage value and the recovery of working capital if the salvage value was calculated by the asset valuation mechanism, whether accounting or commercial.

The recovery of working capital should not be included as a benefit when the salvage value is calculated by the economic method, as it represents the value of the business in operation. None are available as income, although they are part of the equity explained by the investment in the business. Usually, concessionaires must adjust their depreciation and valuation of assets to represent a value of zero at the end of the concession term. However, if for some reason this is not convenient, it is necessary to explain and consider the accounting treatment to make the closing of the concession at the end of the contractual term.

In order to apply the above concepts to an example, consider that a new project's feasibility study is estimated to provide 50,000 units of service per year (such as boat moorings or any general service the reader may wish to imagine) at $500 for each service during the first two years and $600 from the third year, when the service has been consolidated. Sales projections show that, from the sixth year, they could increase by 20%.

The technical study defined an optimal technology for the project that would require the following investments, for a volume of 50,000 units:

Land	$12,000,000
Physical works	60,000,000
Machinery	48,000,000

One of the machines, whose value is $10,000,000, must be replaced every eight years with a similar one. The used machine could be sold at $2,000,000.
A growth in the provision of services to meet the increase in sales would require investing $12,000,000 in additional physical works and $8,000,000 in machinery.

The costs of providing the service for a volume of up to 55,000 units per year are:

Labor	$20
Materials	35
Indirect costs	5

On this level, it is possible to directly import materials at a unit cost of $32.

The fixed costs of rendering the service are estimated at $2,000,000, not including depreciation. The expansion of capacity will increase these costs by $200,000.

Administrative and sales expenses are estimated at $800,000 annually in the first five years and $820,000 when the level of operations increases. Variable selling expenses correspond to 2% commissions on sales.

Current legislation allows depreciating physical works over 20 years and all machines over 10 years.

Intangible assets are amortized on a straight-line basis over five years. Start-up expenses amount to $2,000,000, including the cost of studies, which amount to $800,000.

The investment in working capital is estimated at the equivalent of six months of total disbursable cost.

The tax rate on profits is 15% and the required return on invested capital is 12%.

The aforementioned structure is applied to determine the cash flow:

a) Taxable income: Income comprised of the revenues expected from the sale of services, which is calculated by multiplying the price of each unit by the number of units projected to be sold each year and by the estimated income from the sale of the machine that is replaced at the end of the eighth year.

b) Taxable expenditure: Variable costs resulting from unit cost of service provision, annual fixed cost of operation, sales commission and fixed administration costs and sales expenses.

c) Non-disbursable expenses: Depreciation, amortization of intangibles and book value of the asset sold for its replacement. Depreciation is obtained by applying the annual depreciation rate to each asset, as shown in the following table:

	1	2	3	4	5	6	7	8	9	10	
Initial physical works	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000		3.000
Works, Physical, expansion						600	600	600	600		600
Initial machinery (a)	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800	3.800		3.800
Initial machinery (b)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
Machinery replacement									1.000		1.000
Machinery expansion						800	800	800	800		800
DEPRECIATION TOTAL	7.800	7.800	7.800	7.800	7.800	9.200	9.200	9.200	9.200		9.200

The amortization of intangibles amounts to 20% per annum of the total intangible assets that may be accounted for, including the cost of the study. The book value is the balance to depreciate of the asset that is sold at the end of the eighth year. As it cost $ 10 million and it depreciates over 10 years, its book value is $2 million.

d) Tax calculation: Determined as 15% of profit before tax.

e) Adjustments due to non-disbursable expenses: To eliminate the effect of having included expenses that did not constitute cash outflows, we add depreciation, amortization of intangibles and book value. The reason for including them first and eliminating them later is due to the importance of incorporating the tax effect that these accounts cause in favor of the project.

f) Non-taxable expenditure: These are constituted by disbursements that are not included in the Income Statement at the time they occur, and which must be included as cash flows. At moment zero, the investment in land, physical works and machinery is recorded ($120,000,000) plus the relevant investment in intangible assets (the cost of the study is excluded from the $2 million, because it is a committed cost regardless of the decision about doing or not doing the project). At moment five (end of the fifth year), the investment to undertake the

expansion of production capacity from the sixth year on, and at moment eight, the investment to replenish the asset sold. The investment in working capital is calculated as 50% (half a year) of the annual disbursable costs and is recorded first at moment zero and then the increase in this investment, at moments two and five.

g) **Salvage value:** It was calculated by the economic method, dividing the flow of year ten, with no salvage value, less annual depreciation by the required rate of return.

The following chart shows the result of the project's cash flow.

	0	1	2	3	4	5	6	7	8	9	10
Income		25.000	25.000	30.000	30.000	30.000	36.000	36.000	36.000	36.000	36.000
Sale of asset									2.500		
Variable costs		-3.000	-3.000	-3.000	-3.000	-3.000	-3.420	-3.420	-3.420	-3.420	-3.420
Fixed manuf. costs		-2.000	-2.000	-2.000	-2.000	-2.000	-2.200	-2.200	-2.200	-2.200	-2.200
Sales commissions		-500	-500	-600	-600	-600	-720	-720	-720	-720	-720
Adm. expenses and sale		-800	-800	-800	-800	-800	-820	-820	-820	-820	-820
Depreciation		-7.800	-7.800	-7.800	-7.800	-7.800	-9.200	-9.200	-9.200	-9.200	-9.200
Amortization intang.		-400	-400	-400	-400	-400					
Book value									-2.000		
Profit before tax		10.500	10.500	15.400	15.400	15.400	19.640	19.640	20.140	19.640	19.640
Tax		-1.575	-1.575	-2.310	-2.310	-2.310	-2.946	-2.946	-3.021	-2.946	-2.946
Net Profit		8.925	8.925	13.090	13.090	13.090	16.694	16.694	17.119	16.649	16.964
Depreciation		7.800	7.800	7.800	7.800	7.800	9.200	9.200	9.200	9.200	9.200
Amortization intang.		400	400	400	400	400					
Book value									2.000		
Initial investment	-121.200										
Replacement investment									-10.000		
Expansion investment						-20.000					
Working cap. investment	-3.150		-50			-380					
Salvage value											139.117
Cash Flow	-124.350	17.125	17.075	21.290	21.290	910	25.894	25.894	18.319	25.894	165.011

Investor Cash Flow

The cash flow analyzed in the previous section measures the profitability of the entire investment. If we want to measure return on equity, we must add the effect of financing to incorporate the impact of debt leverage.

Since the interest on the loan is a taxable expense, it is necessary to distinguish which part of the instalment paid to the institution granting the loan is interest and which part is debt repayment as the interest will be incorporated before tax, while amortization, since it is not a change in the company's wealth, is not taxed and must be compared in the flow after calculating taxes.

Finally, the effect of the loan must be incorporated to determine, by difference, the amount that the investor must invest.

There are two possibilities to incorporate these effects, both of which achieve the same result. The first is to adapt the structure, incorporating the effects of debt at each stage. The other is to perform what some call an adapted flow.

In the first case, the general structure of the flow is as follows:

+ Taxable income
- Taxable expenditure
- Loan interests
- Non-disbursable expenses
= Profit before tax
- Tax
= Profit after tax
+ Adjustments due to non-disbursable expenses
- Non-taxable expenditure
+ Non-taxable benefits
+ Loan
- Debt amortization
= Cash flow

If, for the example of the previous section, we assume that the investor can obtain an initial loan of $80,000,000 at a real interest rate of 8% which must be repaid in equal annual installments for eight years, the first thing that will have to be calculated is the instalment amount and the composition of each one considering interest and amortization.
The annual instalment amount is calculated by applying the following equation:

$$C = p\frac{i(1+i)^n}{(1+i)^n - 1}$$

where C is the instalment value, P is the loan amount, i the interest rate and n is the number of instalments in which the debt will be serviced.

Replacing with the background of the example, we have:

$$C = 80.000.000\frac{0,08(1+0,08)^8}{(1+0,08)^8} = 13.921$$

In order to distinguish the part of the instalment that corresponds to interest from amortization, a payment table is drawn up expressing, in the first column, the balance of the debt at the beginning of each year; in the second column, the total instalment amount;

in the third, the interest of the period and, in the fourth, the amount that will repay the initial debt, calculated as the difference between the instalment and interest payable. That is:

Debt balance	Instalment	Interest	Amortization
80.000	13.921	6.400	7.521
72.479	13.921	5.798	8.123
64.356	13.921	5.148	8.773
55.583	13.921	4.447	9.475
46.109	13.921	3.689	10.232
35.876	13.921	2.870	11.051
24.825	13.921	1.986	11.935
12.890	13.921	1.031	12.890

By incorporating the loan amount, the annual interest and the amortization of each period, the investor's cash flow remains as shown in the table below.

Please note that, at moment zero, the net investment is reduced from $124,350,000 in the project flow to only $44,350,000 in the investor flow. By investing this amount, the investor has the net projected debt returns in the last row of the cash flow.

As can be calculated, the percentage yield of the project is 15.77%, in circumstances where the return on equity invested in the same project is 21.97%.

		1 2	3	4	5	6	7	8	9	10
		25.000 25.000	30.000	30.000	30.000	36.000	36.000	36.000	36.000	36.000
Income										
Sale of asset								2.500		
Variable costs		-3.000 -3.000	-3.000	-3.000	-3.000	-3.420	-3.420	-3.420	-3.420	-3.420
Fixed manuf. costs -2000		-2.000 -2.000	-2.000	-2.000	-2.000	-2.200	-2.200	-2.200	-2.200	-2.200
Sales commissions		-500 -500	-600	-600	-600	-720	-720	-720	-720	-720
Adm. expenses and sale		-800 -800	-800	-800	-800	-820	-820	-820	-820	-820
Loan interest		-6.400 -5.798	-5.148	-4.447	-3.689	-2.870	-1.986	-1.031		
Depreciation		-7.800 -7800	-7.800	-7.800	-7.800	-9.200	-9.200	-9.200	-9.200	-9,200
Amortization intang.		-400 -400	-400	-400	-400					
Book value								-2.000		
Profit before tax		4.100 4.702	10.252	10.953	11.711	16.770	17.654	19.109	19.640	19.640
Tax		-615 -705,3	-1.538	-1.643	-1.756,7	-2.516	-2.648	-2.866	-2.946	-2.996
Net Profit		3.485 3.996,7	8.714,2	9.310,1	9.954,4	14.255	15.006	16.243	16.694	16.694
Depreciation		7.800 7.800	7.800	7.800	7.800	9.200	9.200	9.200	9.200	9.200
Amortization intang.		[4] 400 0	400	400	400					
Book value								2.000		
Initial investment	-121.200									
Replacement investment								-10.000		
Expansion investment					-20.000					
Working cap. investment	-3.150	-50			-380					
Loan	80.000									
Debt amortization		-7.521 -8.123	-8.773	-9.475	-10.232	-11.051	-11.935	-12.890		
Salvage value										139.117
Cash Flow	-44.350	4.164 4.024	8.141	8.035	-12.458	12.404	12.271	4.553	25.894	165.011

Another way to get to this investor flow is by taking the cash flow from the project and subtracting the net effect of the independently calculated debt.

This is achieved by incorporating into the already calculated pay table the effect of tax savings on loan interest. By including it as an expense, you can lower the accounting income and, therefore, the amount of tax payable. This can be shown in the following chart:

Debt balance	Instalment	Interest	Amortization	Interest net of tax	Instalment net of tax
80.000	13.921	6.400	7.521	5.440	12.961
72.479	13.921	5.798	8.123	4.929	13.051
64.356	13.921	5.148	8.773	4.376	13.149
55.583	13.921	4.447	9.475	3.780	13.254
46.109	13.921	3.689	10.232	3.135	13.368
35.876	13.921	2.870	11.051	2.440	13.491
24.825	13.921	1.986	11.935	1.688	13.623
12.890	13.921	1.031	12.890	876	13.767

By including the instalment net of tax in the cash flow, you get the same cash flow for the investor that was achieved earlier. This is shown in the following chart:

	0	1	2	3	4	5	6	7	8	9	10
Project flow	-124.350	17.125	17.075	21.290	21.290	910	25.894	25.894	18.319	25.894	165.011
Debt effect	80.000	-12.961	-13.051	-13.149	-13.254	-13.368	-13.491	-13.623	-13.767		
Investor flow	44.350	4.164	4.024	8.141	8.036	-12.458	12.403	12.271	4.552	25.894	165.011

Project Evaluation Criteria

Previously, we have reviewed all the aspects related to preparing the information that will help evaluate a project based on opportunities available in the market. In this sense, the evaluation compares the projected benefits linked to an investment decision with its corresponding flow of projected disbursements.

The objective of this section is to analyze the main techniques to measure the profitability of an individual project. To this end, we are assuming that we are in an atmosphere of certainty, which assumption will later be discarded.

Net Present Value

This concept states that the project should be accepted if its net present value (NPV) is equal to or greater than zero, where the NPV is the difference between all its income and expenses expressed in current currency.

Using the equations defined as part of the financial mathematics fundamentals, we can express the mathematical formulation as follows:

$$VAN = \sum_{t=1}^{n} \frac{Y_t}{(1+i)^t} - \sum_{t=1}^{n} \frac{E_t}{(1+i)^t} - I_0$$

where *Yt* represents the project's revenue stream, *Et* their expenditures and *Io* the initial investment at the zero point of the evaluation. The discount rate is represented by *i.*

Although it is possible to directly apply this equation, the operation can be simplified to a single update by:

$$VAN = \sum_{t=1}^{n} \frac{Y_t - E_t}{(1+i)^t} - I_0$$

which is the same as

$$VAN = \sum_{t=1}^{n} \frac{BN_t}{(1+i)^t} - I_0$$

where *BNt* represents the net benefit of the flow in period t. Obviously, *BNt* can take a positive or negative value.

In applying this criterion, the NPV can have a result equal to zero, indicating that the project returns precisely what the investor demands from the investment. If the result were, say, 100 positive, it would indicate that the project provides that amount of surplus over what is required. If the result were 100 negative, it should be interpreted as the amount that is missing for the project to be as required by the investor.

The Internal Rate of Return

The internal rate of return (IRR) criterion evaluates the project based on a single rate of return per period, with which all the updated benefits are exactly equal to the disbursements expressed in current currency[3]. As Bierman and Smidt point out [4], IRR *"represents the highest interest rate an investor could afford without losing money if all funds to finance the investment were borrowed and the loan (principal and accrued interest) was paid with the cash inflows of the investment as they were being produced."* Although this is a very particular appreciation of these authors (it does not include the concepts of opportunity cost, risk or context assessment of the company as a whole), it serves to clarify the intention of the criterion.

The internal rate of return can be calculated by applying the following equation:

$$\sum_{t=1}^{n} = \frac{Y_t}{(1+r)^t} \sum_{t=1}^{n} \frac{E_t}{(1+r)^t} + I_0$$

where *r* is the internal rate of return. When we simplify and group terms, we have the following:

$$\sum_{t=1}^{n} \frac{Y_t - E_t}{(1+r)^t} - I_0 = 0$$

which is the same as

$$\sum_{t=1}^{n} \frac{BN_t}{(1+r)^t} - I_0 = 0$$

[3] That is the same as calculating the rate that makes the NPV of the project equal to zero.

[4] Bierman y Smidt, *El presupuesto de bienes de capital.* Mexico: Fondo de Cultura Económica, 1977, p.39

Comparing this equation with the previous one, we see that this is equivalent to making the NPV equal to zero and determining the rate that allows the updated flow to be zero.

The rate thus calculated is compared to the discount rate required. If the IRR is equal to or greater than this, the project must be accepted; if it is lesser, it must be rejected.

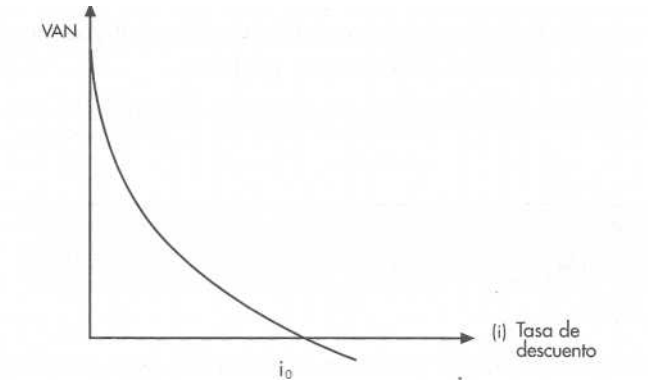
Considering the acceptance of a project whose IRR is equal to the discount rate is based on the same aspects as the acceptance rate of a project whose NPV is zero.

Internal rate of return versus net present value

The two project evaluation techniques analyzed, the IRR and the NPV, may in certain circumstances lead to conflicting results. This can occur when more than one project is evaluated in order to rank them both, because they have mutually exclusive alternatives and because there are capital restrictions to implement all approved projects.

When the decision is only whether to accept or reject, and there is no need for comparative considerations between projects, the two techniques provide equal results. However, in spite of the above, because the Administration must compare the proposed project with other projects that may be mutually exclusive, it is necessary to evaluate the projects by using both indicators.

The following graph allows the discussion of why it will be necessary to use both indicators to compare between projects by the Administration. If the discount rate is zero, the NPV is the algebraic sum of the project cash flows, since the denominator of the corresponding equation would always be 1. As it is updated at a higher discount rate, the NPV decreases.



When crossing the origin (NPV equal to zero), the discount rate *Io* equals the internal rate of return. Recall that IRR is the rate that makes the NPV of the project equal to zero.

Then, if the NPV points to accepting a project when it is zero or positive (i.e. when the discount rate *i* is between zero and *Io*) and if IRR point to accepting when the internal rate of return *r* is greater than or equal to the rate used as the discount rate (r> *i* for any *i* between zero and *Io,* where *r* = Io), both will necessarily lead to the same result.

This is not always as conclusive when you want to prioritize projects. Take as an example the flows of the following table, corresponding to two projects that require equal investment, but which are alternatives to achieve the same purpose, i.e. they are mutually exclusive, and present differences in the receipt of future net income.

Example of divergent flows in the application of IRR and NPV

in project hierarchy

Project	Period			
	0	1	2	3
A	-12.000	1.000	6.500	10.000
B	-12.000	10.000	4.500	1.000

The IRR of project A is 16.39%, while of project B's is 20.27%. From this, we can conclude that Project B should be accepted.

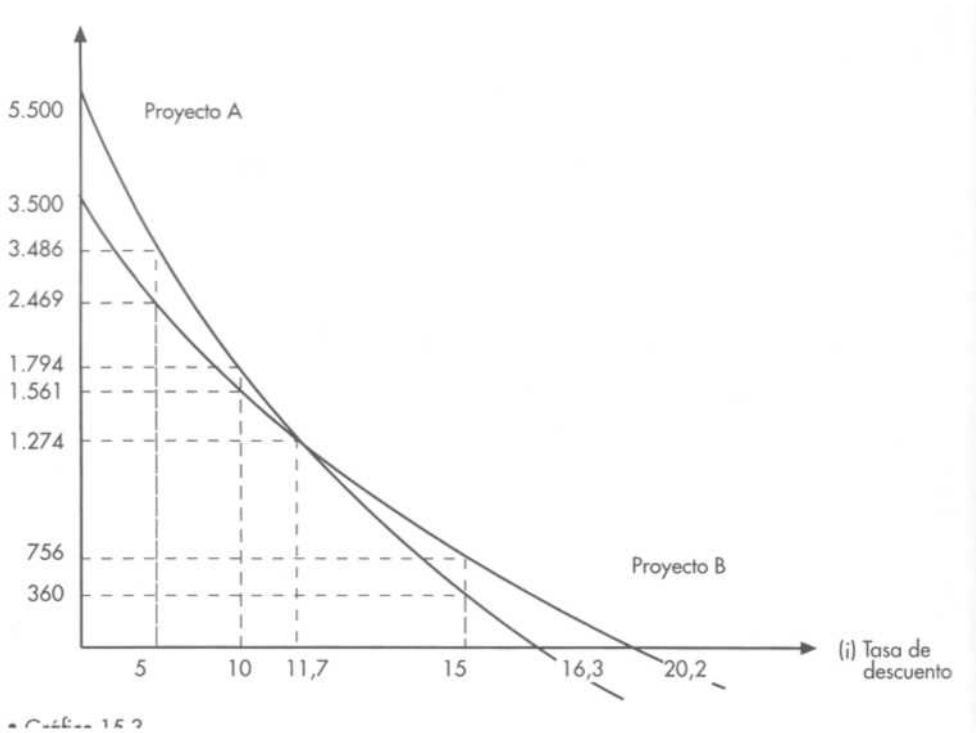
However, if the NPV is analyzed, different results are observed, which depend on the relevant discount rate for the project. The NPVs obtained at different rates are shown below:

Net present values resulting from different discount rates

Project	Discount rate			
	5%	10%	11,72%	15%
A	3.486	1.947	1.274	360
B	2.469	1.561	1.274	756

While the rate is higher than 11.72%, NPV and IRR agree to accept Project B. However, if the rate is less than 11.72%, NPV is higher for Project A, which contradicts the result delivered by IRR.

This situation is best illustrated in the following graph:



The difference in the results provided by both techniques is due to the assumptions on which each one is based. While the internal rate of return assumes that the funds generated by the project would be reinvested at the project rate of return, the net present value involves reinvestment at the expected rate of discount of the company or State, as appropriate.

If we assumed that the proposing company, or the State, act under economic rationality, the funds will be invested until the fringe benefit is zero (NPV of the last project equals zero). That is, until their rate of return equals their expected discount rate. If this were the case, a project with a high IRR can hardly result in the investment of surplus generated by it to redirect to other alternatives of equal rate of return. However, under the assumption of economic efficiency, the company or the State will reinvest surplus at the expected discount rate; if there were higher return rates, they would have already invested in them. It should be noted that some authors question the assumption that IRR reinvests project flows at the same rate.

On the other hand, if we consider that the NPV provides a concrete unit of measure of the contribution of a project to increase the value of the company or the State, the NPV should prevail in the evaluation.

Usually, when prioritizing projects with different service life, it is valid to ask whether to evaluate in the same time frame.

One approach is that, if this is not done, the project with shorter duration is at a relative disadvantage, since the resources generated by it would not be reinvested to generate more funds between the period of its completion and the end of the alternative with which it is compared. However, a State making efficient decisions will have implemented all projects whose NPV is positive or, in other words, with a higher rate of return than the discount rate. Therefore, any marginal investment will be made at least at the discount rate. In this case, the marginal NPV of investing surpluses of shorter-duration project over the period necessary to match the completion date of the longer project is zero and, therefore, irrelevant. That is, it would not make sense to compare the duration of the alternative projects.

However, in case the State is not maximizing its potential to generate economic benefits due to managerial incapacity, restriction in its financing opportunities or others, investing the surpluses of the shorter project at a different rate of return than the discount rate gives a marginal NPV different from zero. In this case, it would be necessary to even out their duration.

Theoretically, there are many ways of matching flows. For example, suppose that both projects are repeated until as many times as necessary to match their completion dates. The limitations are obvious. Another way is to assume that the longer-term project is settled upon completing the shorter one. For this purpose, a settlement value that increases the cash flow of the last period is considered.

Whichever the case, what is important for the purposes of each private initiative project is to clearly justify the assumptions used to compare the project with other alternatives available to the Granting Authority, so that the decision to choose to continue or discard a project is sufficiently documented.

Other Decision-Making Criteria

Many other methods have been developed to evaluate projects, although all are comparatively inferior than the net present value and the internal rate of return. Some do not take into account the time value of money and others, although they do consider it, do not deliver such specific information.

One of the traditional evaluation criteria is the investment recovery period, which determines the number of periods necessary to recover the initial investment. This result is compared with the number of periods acceptable by the proponent or the State. If the flows were identical and constant in each period, the calculation is simplified to the following expression:

$$PR = \frac{I_0}{BN}$$

where *PR,* period of recovery, expresses the number of periods necessary to recover the initial investment *Io* when the net benefits generated by the project in each period are *BN.*

If the net flow differs between periods, the calculation is made by determining the number of periods required to recover the investment by accumulated sum.

The advantage of the simplicity of this calculation fails to counter the dangers of its disadvantages. These disadvantages include that it ignores gains after the recovery period, subordinating acceptance to a liquidity rather than a profitability factor. Nor does it consider the time value of money, by assigning equal importance to the funds generated in the first year with those of year n.

The above can be solved by discounting the flows at the discount rate and calculating the accumulated sum of net benefits updated at moment zero.

Another commonly used concept is the accounting rate of return, which defines an expected annual profitability based on the following expression:

$$TRC = \frac{BN}{I_0}$$

where the accounting rate of return, *TRC,* is a percentage ratio between the expected profit of a period and the initial investment required.

As we can see, this concept is the reverse of the recovery period and, therefore, its disadvantages are similar.

Certain modifications to this concept, such as defining an accounting profit rather than cash flow, only increase its deficiencies.

A third concept traditionally used in projects evaluation is the cost-benefit ratio. When applied taking into account non-discounted cash flows, it entails the same problems already stated regarding the time value of money. These same limitations have led to the use of discounted factors. The following expression is applied for this:

$$RBC = \frac{\sum_{t=1}^{n} \frac{Y_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+i)^t}}$$

which is nothing more than a variation of the equation to calculate NPV, where the denominator was subtracted from the numerator of the *RBC equation.*

A different way of presenting this indicator is:

$$\frac{\sum_{t=0}^{n} \frac{Y_t}{(1+i)^t}}{\sum_{t=0}^{n} \frac{E_t}{(1+i)^t}}$$

where

Y = Income

E = Expenditure (including investment *lo)*

This interpretation is more logical as far as benefits (income) and costs (expenditures including *Io*) are concerned.

It is easy to see that both formulas provide equal information. When the *NPV* Is zero (both subtraction terms are identical) *RBC* is equal to 1. If the *NPV* is greater than zero, the *RBC* will be greater than 1.

The shortcomings of this method with regard to NPV are that it delivers a ratio index, rather than a specific value; it requires more calculations, as two updates are necessary instead of one, and a ratio must be calculated, rather than a simple subtraction.

A method generally used to compare projects with different useful lives is the equivalent net annual value, when the options compared have different associated benefits, or the equivalent annual cost, when only the costs differ.

The equivalent net annual value (NAV) is determined by first calculating the project NPV and then its equivalence as a constant flow. That is:

$$VAE = \frac{VAN}{\sum_{t=1}^{n} \frac{1}{(1+i)^t}}$$

For example, if we compare two projects that present the following information, the NPV of project A is better than the NPV of project B. However, their NAV indicates otherwise:

	Useful life	NPV	NAV	i
Project A	9 years	3.006	630	15 %
Project B	6 years	2.975	786	15 %

Those who suggest this model point out that the NPV cannot be used to compare options

with different useful life since it does not consider an investor's increase in annual wealth.

Alternatively, they propose to "repeat" both projects as many times as necessary to complete them at the same time. For example, for the above case, both projects should be evaluated over an 18-year time span, assuming that the first is repeated twice and the second three times.

Both proposals, however, share an assumption that must be evaluated in each situation before being used: all options can be repeated under the same conditions as the first time only if it is guaranteed that their projection of flows will not be modified, neither by changes in the environment nor changes in the competition or any other factor.

In the cases in which the evaluated projects are to determine which machinery to use, it is highly likely that the methods stated are valid. However, in the case of projects involving public or commercial works, it is quite possible that, at the end of the sixth year, the State or the proposing company do not find a project as profitable as Project B and, if they are efficient, they must invest at the rate of capital cost (being efficient, they will already have invested in all projects that return on their rate of cost of capital). Thus, the NPV of any project that it undertakes from that moment on will be zero, thus rendering any project that, in short, exhibits the largest NPV more attractive.

The NAV or the assumption of replicating the project several times will only be valid when the repetition assumption can be tested.

One way of correcting the effect of different useful lives will be to incorporate a higher salvage value to the equipment with longer life at the service life of the shorter-term project.

The Effects of Inflation in Project Evaluation

Based on the analysis made at the beginning of this section, we can deduce that an investment is the sacrifice of current consumption for greater consumption expected in the future. That being the case, what should be relevant in evaluating a project are the actual flows, rather than their nominal values. Therefore, in economies with inflation, the nominal flows must be converted to constant currency, so that all the information is expressed in terms of purchasing power at the project start period, assuming that this represents the period in which it will be evaluated economically.

Incorporating inflation as an additional factor in project evaluation involves similar procedures, regardless of the criteria used. Said procedure implies that the initial investment, the cash flow and the discount rate must be homogeneous; that is, they must be expressed in constant currency of equal purchasing power. To do so, it is best to work with the prices in force at the time of the evaluation. In this case, the equation to determine *IRR* is applied directly.

If the flows incorporate the expectation of inflation, both in their income and in their

expenditures, the *NPV* is calculated as follows:

$$VAN = \sum_{t=1}^{n} \frac{Bn_t}{\left[(1+i)(1+\phi)\right]^t} - I_0$$

where (1 + 0) represents the discount factor of the flows due to the effect of inflation (0).

However, in order for this equation to be correctly used, all the initial investment must be of a non-monetary nature[5]. But many projects require significant investment in monetary assets; for example, investments in working capital, which decrease the purchasing power of the investment due to inflation. When the initial investment is comprised, partially or totally, of monetary elements, in each period after the evaluation there will be a loss of value for inflation, which must be discounted from the cash flows in the corresponding periods.

If the initial investment were in constant currency, but had a partial component of monetary assets, and cash flow is also in constant currency, the NPV of the project results from the following formulation:

[5] Non-monetary assets are real goods whose real value is not modified in times of inflation (inventories, equipment, foreign currency debt), while monetary assets do change (cash in hand, accounts receivable or accounts payable in national currency).

$$VAN = \sum_{t=1}^{n} \frac{BN_t - \left[\frac{I_0^m}{(1+\phi)^t}\right] x\phi}{(1+i)^t} - I_0$$

Where

$$\frac{I_0^m}{(1+\phi)} x\phi$$

represents the inflation loss that affects the part of the initial investment that has a monetary character (0).

When discounting this inflation loss, the numerator of the sum is expressed in real currency of period zero, so that the assessment is made on a more accurate basis.

Note that, to calculate the *IRR* under these conditions, the procedure is identical. It will suffice to make the NPV equal to zero in the above equation and look for the rate *r* (*i* in the equation) that makes this result feasible.

If, on the other hand, the possibility of indebtedness is considered to finance the initial investment, partially or totally, two similar complementary effects arise. First, since indebtedness has a fixed interest rate per period, the real amount that must be paid for this reason decreases in the presence of inflation. Second, when the loan is amortized over a future period, an inflation gain is also generated from the deferred payment of a fixed amount.

Here, it is of no interest to analyze whether the borrower has added to the interest rate charged an additional factor for their own expectations of an inflation rate. What really matters is to correct the cash flows of the project, so as to express the expected real situation.

To clarify these concepts, suppose the existence of a project that offers the following cash flow:

Period	Net flow
0	-1.000
1	200
2	400
3	700

If 20% of the investment of year zero were financed with a loan repayable at the end of the third year in a single installment, if the interest rate is 15% payable annually, and if the expected inflation were 10% per annum, we would have a financing flow such as the one shown below:

		Financing flow		
Period	Interests	Amortization	Loan	Total flow
0			200	200
1	-30			-30
2	-30			-30
3	-30	-200		-230

As mentioned, the disbursement of interest and amortization generates an inflation gain, calculated by applying an inflation discount factor to the flow, so that:

$$200 + \frac{-30}{(1+0{,}10)} + \frac{-30}{(1+0{,}10)^2} + \frac{-230}{(1+0{,}10)^3}$$

we have:

$$200 - 27{,}07 - 24{,}79 - 172{,}80$$

When combining the project flow with the financing flow, we have:

Period	Project flow	Financing	Net flow
0	-1.000	200,00	-800,00
1	200	-27,07	172,93
2	400	-24,79	375,21
3	700	-172,80	527,20

When we generalize this last case, we can suggest the following equation:

The NPV of this flow will necessarily be greater than that of the original project, since it incorporates the effect of inflation for deferred amortization payments and constant annual interest, which generate inflation gains. In the general case, capital earnings must be compared with interest losses.

$$\sum_{t=1}^{n} \frac{BN_t - \left[\frac{jI_0^p}{(1+\phi)^t} + \frac{I_0^p}{(1+\phi)^n}\right]}{(1+i)^t} - \left(I_0 - I_0^p\right)$$

where j is the interest rate of the loan and $I^p o$ is the amount of the investment financed by the loan. In the case of partial returns of the loan, the power n must be replaced by t in the factor that updates it.

Obviously, it is possible to combine financing and investment variables into monetary assets. To do this, *BNt* of the previous equation must be replaced with the whole numerator of the sum of the NPV equation of the project considering monetary assets. As noted above, the *IRR* in this case is calculated by making *NPV* equal to zero and determining the corresponding *r* rate.

We can also add the inflation expectations of investors that contribute their own capital. However, since this is included by modifying the discount rate, this analysis will be analyzed in the next section, where the determination of the relevant discount rate for the project is discussed in detail.

On the other hand, if evaluated in terms of the internal rate of return, we should mention the concepts of nominal and real interest rates. With inflation, the *IRR* does not constitute an actual measure of the profitability of a project.

If we recall the equation to calculate IRR, we have:

$$\sum_{t=1}^{n} \frac{BN_t}{(1+r)^t} - I_0 = 0$$

In this case, *r* is defined as the nominal rate of the project. It is nominal, because it has not been corrected with respect to the effect of inflation. With inflation, the above expression can be modified by separating the inflation factor from the yield factor. In this case, we have:

$$\sum_{t=1}^{n} \frac{BN}{(1+R)^t(1+\phi)} - I_0 = 0$$

where R is the real rate of return of the project and $(1 + r)^t = (1 + R)^t(1 + \phi)^t$. Then, we just clear R from the above equation to determine the real rate. That is:

$$R = \frac{r - \phi}{1 + \phi}$$

Since the purpose of the IRR is to compare it to a cut-off rate, there is an alternative to

calculate the nominal rate and compare it to a cut-off rate increased by the inflation factor.

Just as we treated financing, all variables that imply inflation losses or gains can and should be included in the model.

Discount Rate

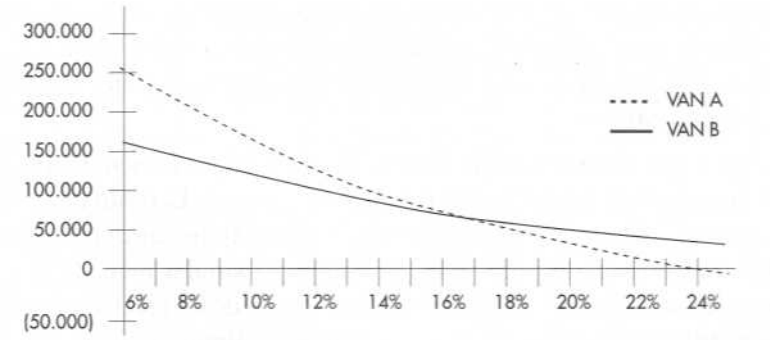
The purpose of this section is to establish general guidelines to consider in calculating the relevant discount rate to evaluate a project.

One of the variables that have the influence on a project's evaluation results is the discount rate used to update its cash flows. Even when all other variables have been adequately projected, using an incorrect discount rate may lead to a wrong evaluation result.

If we consider the discount rate as a continuous function, the NPV of the projects under analysis would behave as shown in the graph below.

The importance of this factor, however, is not commonly recognized in all its magnitude. In some projects, all the partial studies are developed with a high degree of detail, but suffer from inexplicable superficiality in calculating the rate of update.

As explained in the previous section, the NPV of two projects that are compared changes according to the update rate used. This is seen below:



Cost of Capital

The cost of capital is the rate used to determine the present value of future flows generated by a project; it represents the return that should be demanded from the investment to discard an alternative use of resources in projects with similar risk. If different discount rates are used in the same project, one could see how the decision to choose *NPV* changes between two options in the same chart above.

Every company or investor expects certain returns on the implementation of investment projects. Initially, several systems are developed to determine and incorporate the cost of capital, such as price/utility ratios, expected dividends, expected stock returns, returns on marginal projects, and so on. The state also defines expected returns for public investment projects. However, none of these traditional methods incorporates the risk factor associated with the investment.

If the projects were risk-free, there would be no great difficulties in determining the cost of capital, since it would be sufficient to use the return of risk-free assets as an approximation, such as the profitability of government bonds. However, the vast majority of projects are not risk free, so a premium should over the risk-free rate, which depends on how risky the project is.

Over the last forty years, the portfolio theory has been strongly developed, based fundamentally on the quantification of risk in relation to each particular project. Modern theory has linked risk and profitability mainly with models such as the CAPM *(Capital Asset Pricing Model)* and APT[6] *(Arbitrate Pricing Theory).*

Every investment project involves using an amount of resources known today in exchange for an estimate of greater future returns, over which there is no certainty. Therefore, the cost of capital must include a correction factor for the risk it faces. This may not have as much impact on public works projects under traditional financing, in which the State assumes

[6] The APT is a model that argues that the return required on a particular investment is not only explained by the risk that the investment has regarding market risk, but also another set of factors that explain it.

many of the risks associated with the uncertainty of the project. However, in public works concession projects, uncertainty may have a large influence on the discount rate, depending heavily on the risk distribution for each case.

The resources that the concessionaire destines to the project come from two general sources: their own resources and third-party loans. The cost of using their own funds is their opportunity cost (or what they stop winning because they have not invested in another alternative project with a similar level of risk). The cost of third-party loans is the interest on loans adjusted for their tax effect, since they are tax deductible.

The rate to be used depends on the type of cash flow being evaluated. Thus, if the cash flow corresponds to a pure or economic project, the relevant rate for discounting flows corresponds to the opportunity cost of the alternative project with a similar risk level. If the cash flow corresponds to the investor's flow, the relevant discount rate should be a weighted average of the project-specific opportunity cost and the cost of the third-party loans. We should note that, when a project is financed 100% with equity capital, the investor flow is equal to the flow of the pure or economic project.

The search for funding an investment project can result in a fairly large variety of different options. The project evaluator must embark on this search for the best financing alternative for the project being evaluated. Cost flows of each of the financing options must be built to do this, and the one with the lowest current cost value should be chosen. Thus, the proponent who has conceived the project may be thinking of using their own capital to finance the project or partner with other people or companies, or resort to a financial institution. In other cases, they may want to look for options that will decrease their capital requirements through the sale of an asset, the leasing of spaces, vehicles or machinery. Additionally, they could resort to supplier credit.

In large-scale projects, international sources of financing or contributions from the State may be used. This opens up a large range of alternatives, each of which will have different qualitative and quantitative characteristics. The terms, interest rates, repayment forms and guarantees required should be thoroughly studied during the proposal stage, while they should be considered preliminarily at the application stage. Furthermore, one should analyze the barriers that need to be overcome in order to obtain financing; the qualitative characteristics of the procedures to be complied with; the requirements of guarantees; the time that could be elapse from the beginning of the request for the loan until its disbursement, among others. All this should provide the most useful information to document processors and the terms of the tender.

It follows that it is necessary to evaluate all possible financing options. The basic questions to ask yourself are what these options are and what features they have.

The main sources of financing are generally classified as internal and external. Internal

sources include the issuance of shares and retained earnings in each post-tax period. Among the external ones, the most important are loans from suppliers, short- and long-term bank loans, and financial leasing and leasing, as well as different types of indebtedness similar to structured finance.

The cost of using the resources provided by each of these sources is known as the cost of capital. Although the definition may seem clear, determining that cost is generally complicated. The complexity of the subject justifies that many financial texts allocate important parts to its analysis, whose study is outside the scope of this guide. However, the following pages summarize the most important elements of capital cost theory, portfolio theory and its application to project evaluation.

Logically, the sources of internal financing are scarce and, therefore, limit the possibility of carrying out the project. Expecting to finance a project exclusively with own resources implies that the concessionaire company must generate such resources at a time when the project requires it. This jeopardizes the viability of the project, since often the company does not generate the necessary resources or it does not do it at the pace that is demanded. This uncertainty about the financial capacity of the private company can also generate suspicion in the Granting Administration, affecting the progress of the project along the stages of the private initiative.

On the other hand, the advantages of financing with own resources are clear and translate into a lower risk of insolvency and less-pressured management, but they must also be assessed to achieve a balance between risk and cost levels of the source of financing.

The cost of own capital is expressed as the minimum return on profits that can be obtained in projects financed with equity, in order to keep the value of own capital unchanged; that is, the profitability of the project with NPV = 0.

External sources generate different types of credit, with different interest rates, terms, grace periods, risks and readjustment. It is clear that each project can have multiple sources of funding simultaneously. Properly evaluated, this results in the optimal mix of funding.

The project discount rate, or capital cost rate, is the price paid for the funds required to cover the investment. It is a measure of the minimum profitability that will be required for the project, according to its risk, so that the expected return covers the total of the initial investment, the operating expenses, the interest that must be paid for the part of the investment financed with loans, and the profitability that investors demand of their own invested capital.

Although it is possible to define a cost for each of the sources of financing through debt, in order to seek the best alternative of indebtedness, what is important to evaluate the project is determining a weighted average cost rate between these different sources of financing.

According to previous sections, there are several ways to present the cash flow of the project. However, it is important to note that this should be consistent with the selected discount rate.

One way to evaluate the project is to choose a rate representative of the cost of capital, or equity, and apply it to the flow discount for the investor, although the most common procedure is to evaluate the project flow at the capital cost rate of the private company. This point is then analyzed for projects with the same risk for the private sector.

Cost of Debt

Measuring the cost of debt, whether the concessionaire company uses bonds or loans, is based on the fact that these must be repaid at a specific future date, in an amount generally greater than that originally obtained. The difference is the cost to be paid for the debt. For example, if it is possible to get a loan at 11% annual interest, the cost of debt is defined as 11%.

The cost of debt is symbolized as kd and represents the cost before tax. Since borrowing interest on the loan is deducted from profits and allows for lower taxation, it is possible to directly include in the discount rate the effect on taxes, which obviously will be lower, since interest is deductible for the tax calculation. The cost of debt after tax is:

$$k_d(1-t)$$

where (t) represents the tax rate.

Suppose, for example, that a project has a profit before interest and taxes of $10,000 a year. If the investment required to achieve this profit is $40,000, the interest rate charged on the loans is 11% per year, and the tax rate is 20%, the following financing alternatives are available:

	With debt	With own capital
Profit before tax and interests	$10.000	$10.000
Interest (11 % OF $40.000)	-$4.400	
Profit before tax	$5.600	$10.000
Taxes (20%)	-$1.120	-$2.000
Net Profit	$4.480	$8.000

In both cases, the project will yield the same profit before taxes and interest, since the operating result is independent of the source of financing. The alternative with debt forces one to incur a cost of $4,400 in interest. However, by reducing pre-tax profits, the tax payable is reduced from $2,000 to $1,120, just because of the debt. Then, the higher interest cost is accompanied by a benefit represented by a lower tax. Note that net profit decreased from $8,000 to $4,480; i.e. $3,520. Consequently, the real cost of the debt is $3,520, which represents only 8.8% of the debt. This would have been equally obtained by replacing, in the following equation:

$$0.11\ (1 - 0.20) = 0.088$$

It is important to note, though it may seem obvious, that tax benefits will only be achieved if the company undertaking the project has, as a whole, accounting profits. Although the project contributes accounting profits, it will not attain the tax benefit of financial expenses if the concessionary company overall has accounting losses.

When a company or an investor applies for a loan to finance part or all of the investment, they must establish a payment plan with those who granted the loan. The sum of financial expenses and capital amortizations is the total amount paid by the company. It is possible that, when evaluating projects financed with a percentage of debt, they are more attractive than those financed 100% with equity. This is basically due to three reasons: a) if the present value of the capital amortizations is calculated and compared to the amount of the loan, we observe that the loan amount is greater because of the influence of the present value of capital amortizations over NPV is lower than if they used resources with their own capital; b) financial expenses are tax deductible, which means that the cost of debt is not the bank or any third-party placement rate, rather it must be adjusted for its tax effect; and c) the weighted rate must necessarily be lower than the cost of equity, because the cost of credit is lower than the equity cost, thus leading to a higher NPV.

The tax effect of debt can be incorporated into the rate or flows. The cost of capital of a company or project can be calculated by the weighted costs of the different sources of financing or by the required return on assets, given their level of risk.

Upon defining the discount rate for a concessionaire, all projects with the same risk characteristics will be evaluated using this rate, unless the risk conditions implied in its calculation change. If so, it eliminates the problem of having to determine a rate for each investment project under study.

Many companies estimate the discount rate to discount cash flows from new investment projects through the return demanded by investors on their shares. This methodology is advisable for riskier companies, but it can lead to make wrong decisions if the new projects do not have the same risk of the company. Therefore, the correct discount rate depends on the project risk and not on the company risk.

Cost of Own Capital or Equity

In the evaluation of a project, equity capital is the part of the investment that must be financed with own resources.

In a concessionaire company, its own resources may come from the project operation, by retaining the profits to reinvest them in new works or equipment, or from new contributions from the partners.

The literature is very profuse in capital costing models from specific sources internal to the project. For the purposes of this guide, we will develop the concept of opportunity cost of the investor to define the cost of own capital.

In general terms, we can say that the investor allocates available resources to the project if the expected return compensates for the results that could be obtained by allocating those resources in another investment alternative of equal risk. Therefore, the cost of equity, ke, has an explicit component that refers to other possible applications of investor funds. Thus,

the implicit capital cost is an opportunity cost that encompasses both expected rates of return on other investments and the opportunity for present consumption. The investor is willing to sacrifice present consumption if the consumption that this sacrifice gives him in the future is greater. Future consumption also has an opportunity cost equivalent to the cost of not consuming in the present.

Given that usually investors have several simultaneous investment alternatives through investment portfolios (zero-risk deposits in treasury bonds, deposits in the financial market with some degree of risk, purchase of brokers with greater risk or investing in other projects), they will obviously choose to take as the opportunity cost of the investment the best expected return after its risk adjustment. This can become a determinant in the participation of investment companies in the bidding processes.

As indicated above, there are various forms and models to estimate the cost of equity. The rest of this section focuses on CAPM, as it is most widely used in determining the cost of capital.

The cost of own capital can be calculated by using the risk-free rate (Rf) plus a risk premium (Rp). That is:

$$k_e = Rf + Rp$$

The risk-free rate is generally the rate of investment documents placed in the capital market by governments.

The risk premium corresponds to an investor's requirement for having to take a risk by opting for an investment other than that which reports an assured profitability. The higher profitability required can be calculated as the historical mean observed between market return (Rm) and the risk-free rate. That is:

$$Rp = Rm - Rf$$

An alternative way of calculating the cost of own capital for a project that is evaluated in a running concessionaire is by assessing the dividends, if any:

$$k_e = \frac{D}{P} + g$$

where (D) is the dividend per share paid by the company to its shareholders, (P) is the share price and (g) is the expected growth rate. For example, if the stock market price of company shares is $2165, the dividend to be paid per share is $184, and if future growth is expected to be constant annually at a rate of 4%, the cost of the own capital is:

$$k_e = \frac{184}{2.160} + 4\% = 12,5\%$$

The Capital Asset Pricing Model (CAPM)

This model comes from the theory of the portfolio (investment pool), which tries to explain the risk of a given investment through the existence of a positive relationship between risk and return. The portfolio theory focuses its analysis on relating the risk of an investment portfolio, measured by the standard deviation of the portfolio, and the expected return of that risky portfolio E(Rp). When investors are faced with the decision to undertake a particular investment, they not only evaluate and quantify the risk associated with the investment itself; they also evaluate and quantify how it affects the set of investments held by the investor by correlating the profitability of the private investment with the expected return on the market. In general terms, this profitability can be observed according to the behavior of the general prices index of all stocks in the economy, considering the performance of all economic sectors: energy, mining, metallurgy, fishing, forestry, and so on.

The total risk of the investment pool can be classified as systematic or non-diversifiable risk,

limited to fluctuations in other investments affecting the economy and the market, and non-systematic or diversifiable risk, which corresponds to the specific risk of the company, as it does not depend on market movements such as possible strikes, new competitors, and so on.

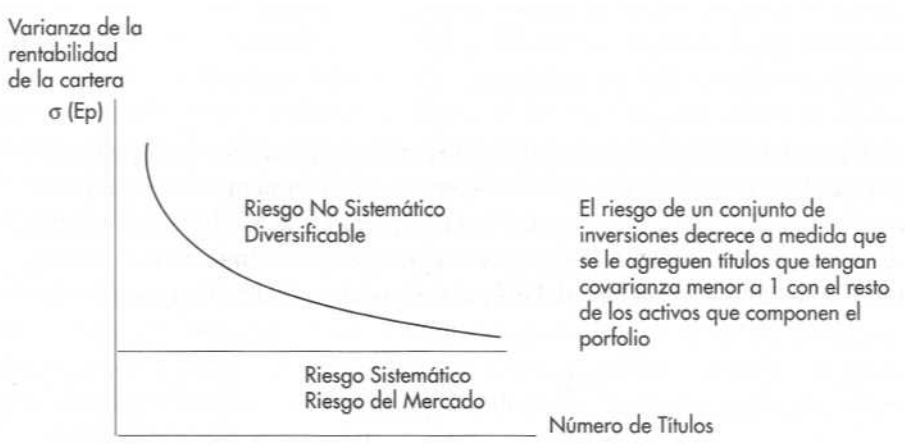
Non-systematic risk can be reduced by diversifying the investment in several companies.

The Capital Asset Pricing Model (CAPM) approach is based on the fact that the only source of risk that affects the profitability of investments is market risk, which is measured by beta, which relates the project risk to the market risk.

This model suggests the existence of an efficient frontier [7]of investment portfolios comprised of the combination of different assets, especially the market portfolio (comprised of a weighting of all the assets of the economy[8]) and risky stock in addition to the existence of a risk-free asset (Rf). The combination of these elements creates the Capital Market Line, which extends the range of investment possibilities. In it, each investor will make their particular decision on the composition of their investment portfolio depending on their greater or lesser risk appetite, borrowing or lending at a certain interest rate.

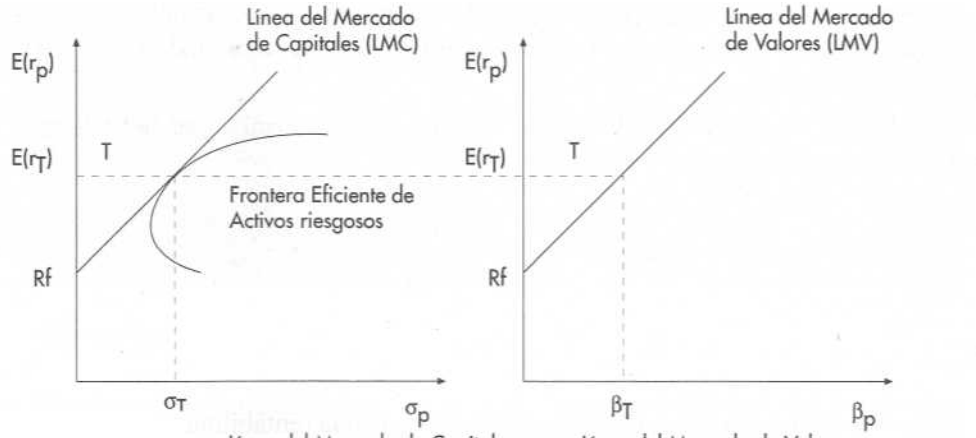
[7] The efficient frontier means that at a given a level of risk for a set of investments or an investment portfolio, we gain the maximum return. In other words, at a given level of return, we have the minimum risk. The mathematical derivation of this model is not the objective of this guide, as it is found in specific finance textbooks.

[8] Known as the tangency T portfolio.



The stock market line is created based on the capital market line. The stock market line relates the risk of the project or the individual investment to market risk, which serves to determine the expected profitability of the particular investment one wishes to implement. The relationship between the risk of the project and the market risk is known as β. Beta measures the sensitivity of a change in the profitability of an individual investment to the change in the overall market profitability. That is why, for market risk, it will always be equal to 1. Banks, for example, when participating in most sectors of the economy, have a beta close to 1.

If a project or investment shows a beta greater than one, that project is riskier in relation to market risk. An investment with a beta less than 1 means that the investment is less risky than market risk. An investment with β equal to zero means that it is a risk-free investment, such as treasury bonds.



Línea del Mercado de Capitales versus Línea del Mercado de Valores

In the first graph, the axis of the abscissa measures the risk of a portfolio p through the standard deviation Op and OT the risk of the tangency portfolio with an expected return E(RT). This expected return is projected through the stock market line and a beta is obtained for that particular portfolio, measured on the horizontal axis by the beta of any portfolio (Pp).

Thus, to determine the cost of own capital or equity by this method, the following equation should be used:

$$k_e = Rf + \left[E(Rm) - Rf\right]\beta$$

where E(Rm) is the expected market return.

For example, if the risk-free rate were 6%, the observed rate of return on the market was 13% and the beta of sector 1.5, the rate of capital cost would be:

$$k_e = 6\% + (13\% - 6\%) * 1,5 = 16,5\%$$

The problem of the project preparer and evaluator arises when you must estimate the beta corresponding to the investment you are evaluating. Some economists argue that betas can be used in sectors where you intend to invest and, from them, determine the relevant discount rate. The parameters of the risk-free rate and expected market return E(Rm) are objective and observable. Rf can be calculated from the rate or profitability of long-term Treasury bonds and E(Rm) based on the market's historical return, which is commonly measured through the historical performance of the stock market[9].

Financial theory points out that the formula to determine the beta of a given investment is[10]:

$$\_ \frac{Cov\,(Ri,\ Rm)}{Var\ (Rm)}$$

where *Ri* is sector profitability i and *Rm* market profitability.

For example, in order to determine the beta of a particular sector, if the sector and market returns are known (shown in the table below for the last five years), you can develop the

9 The return of the stock market is commonly considered as a measure of the expected return on the market, since it is difficult to consider the expected profitability of all projects in the economy. Some researchers use the Standard & Poor's SU 500 composite index covering the 500 most traded stocks on the New York Stock Exchange.

10 The variance and covariance of two data sets are calculated in an electronic spreadsheet, such as Excel, for example. The covariance is calculated directly using the function option of the Insert menu, by selecting *Statistics* under the Function Category and choosing *COVAR* in the function name. The range of values is then selected in the corresponding boxes. This procedure is similar to the *VAR function*.

chart that allows finding the covariance of the sector in which you want to invest, with the market in general and the market variance.

Year (t)	Ri(t)	Rm(t)
2004	-0,01	0,09
2005	0,04	0,08
2006	0,07	0,11
2007	0,09	0,18
2008	0,12	0,15
Sum	0,31	0,61
Average	0,062	0,122

Year(t)	Rit	Rmt	Rit-Ri	Rmt-Rm	(Rit-Ri)(Rmt-Rm)
2004	-0,01	0,09	-0,07200	-0,03200	0,00230
2005	0,04	0,08	-0,02200	-0,04200	0,00092
2006	0,07	0,11	0,00800	-0,01200	-0,00010
2007	0,09	0,18	0,02800	0,05800	0,00162
2008	0,12	0,15	0,05800	0,02800	0,00162
Sum	0,31	0,61			0,00638
Expected average or profitability	Ri=0,062	Rm=0,122		Cov (Ri,Rm)	= 0,0012760

Rit Represents the profitability or return of sector *i* in period t. *Rmt* Represents the market profitability in period t. This way, we have sums and averages to determine the deviation of the profitability of the industrial sector and market with respect to its average or expected return (Rit-Ri) and (Rmt-Rm), respectively. Then, the result of multiplying these deviations ((Rit - Ri)(Rmt - Rm). By dividing this value (0.00638) by the number of data, which in this example is five, we get a covariance of 0.001276.

To calculate the beta, the market variance must be determined. To do so, the variance formula must be used:

$$Var\ (Rm) = \frac{\sum (Rmt - Rm)^2}{n-1} = 0,00177$$

In this way, when applying the beta equation, we get obtains:

$$\beta = \frac{Cov\ (Ri, Rm)}{Var\ (Rm)} = 0,720904$$

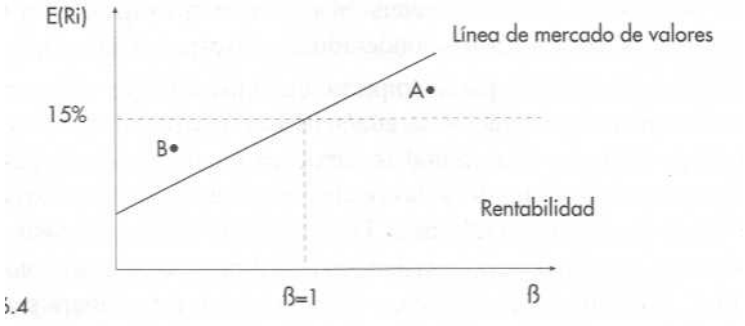
Average business rate versus CAPM

It is common to observe that private companies use a certain discount rate to evaluate their investment projects, regardless of the level of risk that these investments may have. When evaluating an individual investment project, the cost of capital of the company may not represent the opportunity cost of a new project, which could have greater or lesser risk to the company.

For example, supposing a company with a level of risk associated with beta = 1 is evaluating the possibility of doing two alternative projects, A and B. Given this level of risk, the company demands 15% profitability from any investment. According to this criterion, project B, with a return of 14%, will be rejected, as it does not return 15%, and project A will be accepted, as it reports a return (16%) above the requirement.

If each project's level of risk had been considered, the decisions would be opposite. Since project A has a higher level of risk than the company's (beta greater than 1), it must be required a rate of return to exceed 15%, determined by the stock market line. On the other hand, project B should be accepted, as it has a lower level of risk (beta less than 1) and the required return should be less than 15%.

Therefore, if the project risk is above the company average, it cannot be required a return equivalent to the cost of capital of the company. The rate that will be required for the investment depends on the project beta and, therefore, on the preferences of investors regarding the relationship between risk and profitability.
This is not only valid for the investment decisions of companies; it also applies to the decisions of the State.



If the project being evaluated is an extension of the existing works, it can be assumed that the risk does not vary. If it were necessary to create a new work, the sectoral beta can be taken as a good reference. You can also opt for the sector beta when the project being evaluated is in a sector different from the sector of the company.

Weighted Average Capital Cost (WACC)

After defining the cost of the loan, kd, and the required return on equity, ke, a weighted discount rate, ko, should be calculated to incorporate the two factors into the appropriate proportionality.

As its name implies, the weighted average cost of capital is an average of the costs relative to each of the sources of financing that the company uses, which are weighted according to the proportion of costs within the defined capital structure. According to this:

$$k_o = k_d \frac{D}{V} + k_e \frac{P}{V}$$

where (D) is the amount of debt, (P) the amount of equity and (V) the value of the company in the market, including debt and contributions. As can be seen from this equation, the weighting of the cost of debt and the cost of equity depends on the debt/asset ratio or debt-to-value ratio of the firm.

This model assumes that the firm's equity is the sum of the values of the assets. When the project evaluator determines the average capital cost to discount the projected flows and faces a project financed partly by equity capital and partly by debt, it should determine the percentages of the total investment that correspond to debt and equity to establish the corresponding weights of D/A and P/A.

In this regard, we should note that the concessionaire, to the extent that it is amortizing capital, is changing the debt/asset and equity/asset ratio indirectly, since the more capital is amortized, the lower the debt, which means that the weights of the rates that make up the formula are changing, varying the relevant discount rate. Thus, strictly speaking, if capital is amortized in each period, there will be a different discount rate for each period. However, in evaluating the project in the long term, they should be able to pay the debt acquired for implementation. Thus, in the long run, the relevant discount rate will be the cost of own resources. This is why some economists argue that debt-financed flows can be discounted at equity cost.

When the cash flow has not been corrected according to the tax effects of financial expenses, it must be updated using a tax adjusted weighted discount rate, k'o, resulting from:

$$k'_O = k_d(1-t)\frac{D}{V} + k_e \frac{P}{V}$$

For example, if a project that requires a total investment of $1,000 (value of the concessionaire company) is to be financed at 60% with debt at 8% annual interest and at 40% with own contributions, for which a return of 14% is demanded, the weighted cost of

capital for a 15% tax on profits would be 9.68%, provided the company is assumed to maintain the current debt structure in the future.

$$k'o = (8\%)\ (1\text{-}15\%)\ (60\%) + (14\%)\ (40\%) = 9{,}68\%$$

When the interest and repayment of the loan are deducted from the project cash flow, the surplus remains for the investor. When comparing this flow with the contribution of own capital and updating it at the relevant discount rate for the investor ke, it should indicate the NPV of investment, after fulfilling the obligations contracted with indebtedness.

Some authors argue that projects that are evaluated with flows financed with equity and debt should be evaluated with an adjusted NPV. The adjusted NPV is achieved by determining the NPV of the pure project. At the same time, we must build the

flow of financial expenses corresponding to the debt and establish the present value of the tax benefit of the debt using the rate of cost of debt. When adding both NPVs, we have the adjusted NPV of the investment.

Risk is commonly perceived as a non-negligible likelihood of getting poor results when making an investment. Therefore, it is common to add factors and arbitrary adjustments to the discount rates, which can lead to bad decisions.

These adjustments arise from the fear of taking a wrong decision based on their forecasts of cash flow behavior, so they try to hide errors by adding an additional factor to the discount rate. This approach is not highly recommended; strictly speaking, what should be done is to adjust the flows by a certain probability and then make the investment decision based on an expected NPV. Thus, the projected cash flows would reflect the probabilities of all possible outcomes, good and bad. If flows are adequately calculated, the discount rate should reflect only the project market risk, i.e. no additional element should be included to reflect the risk of the variance of the projected flows.

The following tables can serve as a guide to determine the indicators specific to each financial analysis.[13] Before using these values as part of a financial analysis for private initiative projects, it is advisable to review the methodology used by the authors to verify the assumptions for each case.

Sectoral Betas

1 Sector	Beta value (B) 1
Roads	0.62
Ports	0.55
Airports	0.75
Railways	0.90
Public Transportation	0.66
Power generation	1 22
Power distribution (Utilities)	0.60
Telecommunications	0.75

Source: Compilation based on sources from the World Bank and Harvard Business Review

1 These values are the results presented in the study "Development of an Integral Program of Concessions and Design of Financing Schemes for Implementation, Including Private Initiative Models," prepared by Grupo Sur - IKONS ATN.

Leveraged Betas by sector and country

Country	Transportation					
	Highways	Ports	Water	Telecom	Distribution	Energy 1 Generation 1
Argentina	1.17	1.00	0.68	1.51	0.94	0.61
Bolivia	1.14	0.98	0.67	1.48	0.92	0.60
Brazil	1.31	1.12	0.76	1 66	1.03	0.68
Chile	1.17	1.00	0.68	1.51	0.94	0.61
Colombia	1.17	1.00	0.68	1.51	0.94	0.61
Mexico	1.26	1.08	0.74	1.61	1.00	0.66
Panama	1.21	1.04	0.71	1.56	0.97	0.64
Peru	1.21	1.04	0.71	1.56	0.97	0.64
Venezuela	1.18	1.01	0.69	1.52	0.94	0.62

Source: Adapted from World Bank (2005) "How Profitable are Infrastructure Concessions in Latin America? Empirical Evidence and Regulatory Implications"

Return on capital by country and sector

Sector/ Return E(r)	Belize	Honduras	Guatemala	Panama	El Salvador	Costa Rica	Nicaragua
Roads	20.09	14.84%	11.84%	11.84%	10.57%	11.84%	15.59%
Ports	19.75	14.50%	11.50%	11.50%	10.23%	11.50%	15.25%
Airports	20.73	15.48%	12.48%	12.48%	11.21%	12.48%	16.23%
Railways	21.46	16.21%	13.21%	13.21%	11.94%	13.21%	1696%
Transportation	20.28	15.03%	12.03%	12.03%	10.76%	12.03%	15.78%

STUDY: DEVELOPMENT OF AN INTEGRAL PROGRAM OF CONCESSIONS AND DESIGN OF FINANCING SCHEMES FOR IMPLEMENTATION - NATIONAL CONCESSIONS COUNCIL OF COSTA RICA - SEP. 2007

Estimated cost of sectoral capital for Costa Rica

Sector	WACC
Roads	8.01%
Ports	7.91%
Airports	8.21%
Railways	8.43%
Public Transportation	8.07%
Power generation	8.90%
Power distribution (Utilities)	7.98%
Telecommunications (Telephones)	8.21%