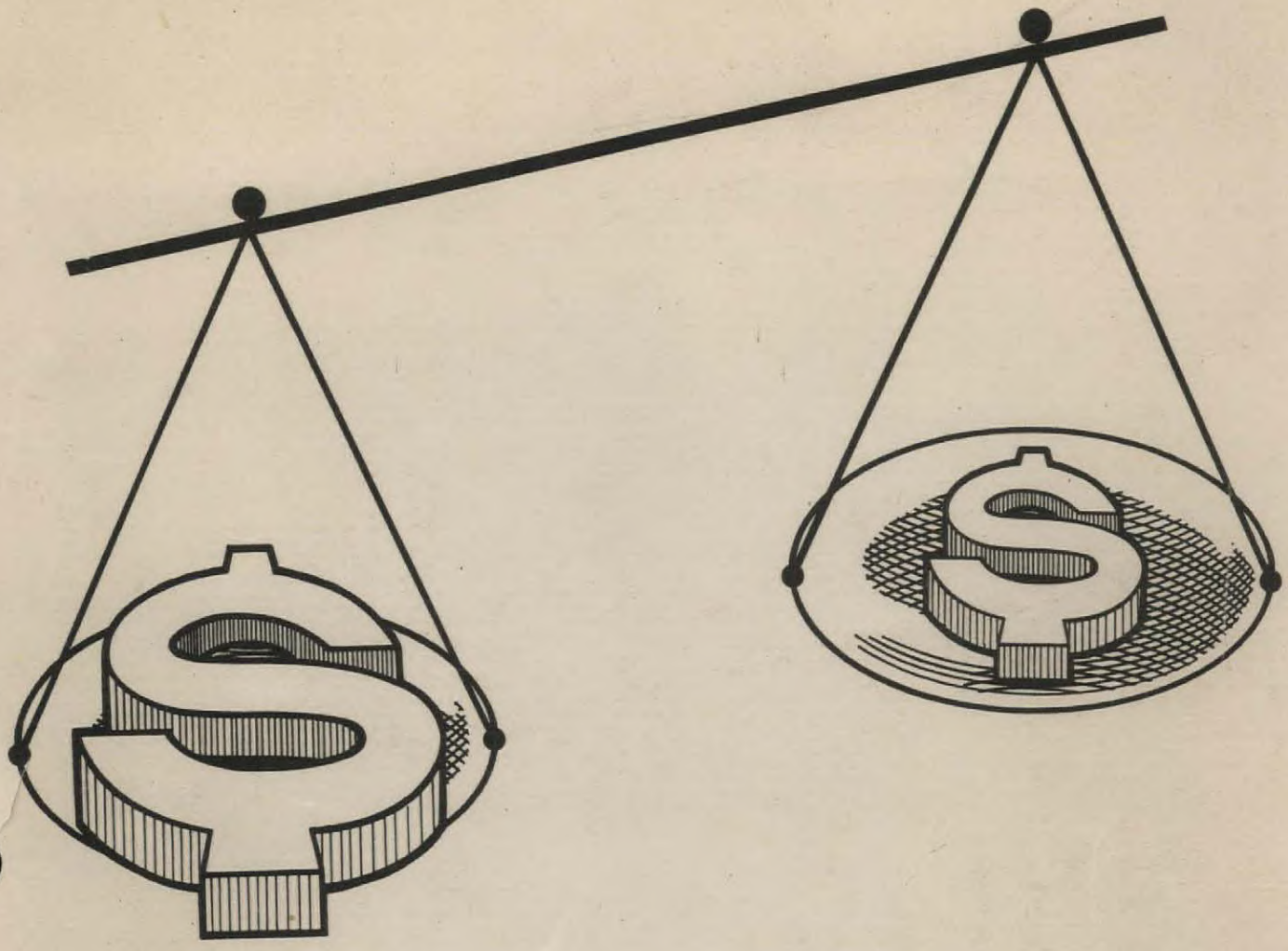
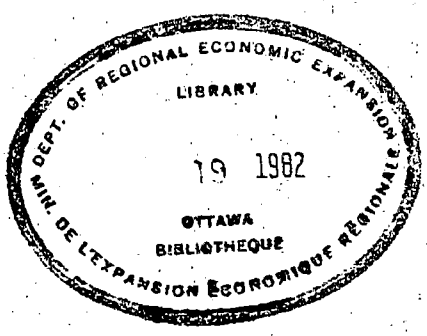


BENEFIT - COST ANALYSIS

For RDIA Projects

Canada

Benefit-Cost Analysis for RDIA Projects



Walter G. Hughes
Evaluation
Planning & Coordination
Department of Regional
Economic Expansion
Moncton, N. B.
March 1981

ACKNOWLEDGEMENT

I am indebted to Gordon DeWolf, Brian Dick, Keith Draper, David Thomas, and G.Y. Kuo, all with the Department of Regional Economic Expansion, for their many helpful comments and suggestions.

PREFACE

The Regional Development Incentives Act requires that the Minister, in determining whether to authorize the provision of a development incentive, take into consideration the extent of the contribution that the establishment, expansion or modernization of the facility would make to economic expansion and social adjustment in the designated region. The recognized technique for evaluating such a contribution is benefit-cost analysis (BCA). This manual was written as a step by step guide to benefit-cost methodology as applied to RDIA case evaluation.

BCA was designed specifically to help governments determine whether to undertake public programs or investments. Its use has been extended to assist with decisions on regulated industries and government assistance to the private sector. There is considerable agreement among economists concerning the procedures that should be used in evaluating the economic effects of projects, and an extensive literature exists on applications in most fields of government activity.

The variety of analytical problems to be addressed and the ingenuity which must be exercised in estimating costs and benefits make it particularly difficult, if not impossible, to design an all-purpose BCA procedure. The following benefit-cost guide has been written as a simple standardized method for evaluating RDIA manufacturing projects. This standardization allows for the comparability of economic effects across projects, regardless of the nature of the project.

In determining the net social-economic benefit of a project, benefit-cost analysis provides the rationale for government assistance to a firm. However, it should be emphasized that a good BCA is dependent on a prior financial analysis for most of its informational inputs. A financial analysis is required to determine the on-going viability of the project, as well as to determine whether the firm in fact requires financial assistance. Furthermore, a financial analysis is dependent on prior marketing and engineering analyses. Thus, a BCA is only one tool in a more complete evaluation of a proposal.

TABLE OF CONTENTS

A SIMPLIFIED APPROACH TO BENEFIT-COST ANALYSIS

In simplest terms, benefit-cost analysis (BCA) is merely the adding up of all the pluses and minuses of a project in a systematic manner. It provides decision-makers with a consistent and comprehensive framework in which to weigh the various financial and social trade-offs involved in a project. This makes it a powerful tool.

The big difference between BCA and an investment appraisal undertaken by a firm is the objective of the analysis. The firm attempts to maximize its profit while the government seeks to maximize the well-being of Canadians. Accordingly, a benefit-cost analysis is undertaken from the perspective of the entire society, not just that of the firm.

There are two essential tasks that BCA performs in measuring the impact of a project on national welfare:

1. It measures the net increase in national output resulting from the project; and

2. it enters into the decision framework the social benefits and costs.

The following paper demonstrates how these tasks are handled. The guide is divided into three sections. The first section outlines the theoretical foundation of BCA. The second section deals with the more practical questions of how to calculate the economic surplus generated by a project. The final section provides a detailed case study.

Section I

THEORY

THE METHOD OF BENEFIT-COST ANALYSIS

Much of BCA methodology is incomprehensible without an appreciation of the distinction between real resources and financial resources. The distinction is simple enough. "Real" refers to physical, tangible phenomena, whereas "financial" refers to money. Benefit-cost analysis is an evaluation of the efficiency with which real resources are converted into real goods and services. Financial analysis is concerned with this efficiency as well, but it also takes into consideration things that have no immediate link to the real (i.e. physical) world, e.g., taxes, transfer payments and interest payments.

With this distinction in mind, the method of BCA can be presented straight forwardly:

(a) the analyst first identifies the real outputs and inputs created or consumed directly by the project;
(b) the analyst then assesses the value of the output created and the cost of the inputs consumed;
(c) next the analyst assesses the indirect impact of the project on the level of real national output. In the methodology presented, this assessment is simplified by the use of adjustment factors;
(d) finally, the analyst organizes the data into summary statistics which indicate the net economic value of the project.

IDENTIFICATION OF REAL IMPACTS

The analyst begins by identifying and listing all real impacts that would be caused directly by the proposed project. The general impacts listed below are characterized as being either inputs or outputs.

Output	Inputs
Goods are produced	Fixed capital (i.e. buildings, machinery and infrastructure) is used.
Pollution is created	Material supplies are consumed.
	Land is occupied.
	Labor is employed.

These real effects may also be characterized as being either benefits or costs. The goods produced are

obviously a benefit to society. Pollution on the other hand is obviously a cost. It is an example of what economists refer to as an externality of production. Externalities will be discussed in greater detail in a later section.

The inputs listed above would all seem to be costs to society. Actually, they would be considered costs in an economic sense only if society had an alternative use for them. Otherwise, they would be ignored. This is the notion of the opportunity cost of a factor of production.

VALUATION

Once all real inputs and outputs have been identified, they can be valuated. Output is valuated according to the principle of "willingness to pay". A good or service is worth whatever consumers are willing to pay for it. Inputs are valuated according to the principle of opportunity cost. According to this, a factor of production is worth its value in its best alternative use.

The preceding rules are applied obviously in appraising goods bought and sold outright in the market place. The same rules can be applied equally well for non-market goods, such as a clean environment, city parks, or family size. Any choice in which so much of one thing is traded off against so much of another, can be interpreted as an economic choice. The rate at which one thing is traded off against another is its price relative to the other. Thus, economists postulate markets in which social goods can be observed to be "traded" in situations where no financial transaction takes place. This is in fact what economists do to appraise the value of the leisure time of the unemployed. The following paragraphs deal with the practical questions of estimating the value of inputs and outputs.

Value of goods produced - The criterion to be used in setting a value on the output of the project is the consumer's willingness to pay for the good. This would be at least equal to the price that the consumer does pay for the good, inclusive of all taxes. The analyst is unlikely to know the final consumer price, because included in this price is the middlemen's margin by which the consumer pays for the services provided by distributers, wholesalers and retailers. The middlemen's margin is ignored in the analysis as are the services that middlemen provide. Therefore, the benefits from production are equal in value to sales revenue plus the federal and provincial taxes that would be generated.

Appendix A provides information on the various consumption taxes applied on production/consumption in Canada.

Value of fixed capital - For purposes of benefit-cost analyses, it is inconsequential who pays the cost of fixed capital. The analyst is required specifically by the Regional Development Incentives Act to take into consideration not only the investment in fixed capital by the firm but also that investment in infrastructure required of all levels of government. This governmental investment may take such forms as new sidewalks, water and sewerage extension, and street lighting. The analyst will have to assess the degree to which the additional investment in infrastructure is necessitated by the proposed project.

The analyst is cautioned to ignore sunk costs. If the project requires the purchase of mothballed machinery or a highly specialized but idle building such as a refinery, and if the only alternative use of these assets is to scrap them, then their scrap value would be considered their opportunity cost.

Accountants and economists apply different rules as to the timing of the cost of fixed capital. An accountant is concerned with when payments are made on buildings and machinery. These may be mortgaged over many years. The economist is more interested in the time at which the fixed capital ceases to be available for alternative use. The entire cost of fixed capital is incurred then. This effectually expenses all capital items and dispenses with interest payments and depreciation.

Value of material supplies - Government subsidies received by a supplier to the RDIA project may permit the market price of the input to be less than its true economic cost. This subsidy is likely to be inconsequential unless the input is a major ingredient into the production process. If that should be the case, then an effort should be made to estimate what the price of the input would be in the absence of the subsidy. The most common example of a subsidized input for manufacturing projects is the subsidization of energy. At the time of this writing (Fall, 1980) the rule of thumb method of adjusting for energy costs is to double them.

The value of land - The economic value of land is its market value. Usually, the applicant does not include this cost in his application to DREE as it is a non-eligible cost. The analyst should assess the competitive market value of the land and attribute that cost to the project, even in the case where the lot already belongs to the firm, for in the absence of the project the firm could sell the parcel of land.

The value of labor - A project's workers may come from other jobs or from the ranks of the unemployed. If a

worker is taken from another job, his former position may be refilled by a person who is currently unemployed. This is the "trickle down" notion of job creation. Jobs are said to trickle down to the unemployed. There may be several links in this chain before a job works its way down to the unemployed and sometimes the chain is broken before an unemployed person is hired. In this case, a worker leaves his current job for another and his position is left unfilled. When this occurs, society loses the output that the worker would have produced in the other position.

The value of this lost output is the opportunity cost of a previously employed person. This is generally taken as the wage at the alternative plant, on the belief that the value of the work done by a worker is equal to his wage. Since it is generally the case that the prior wages of workers are unknown, their wage on the project is taken as a reasonable proxy. Thus, the opportunity cost of the work force who are assumed to have been previously employed is equal to their wages.

The remainder of the work force come from either the ranks of the unemployed or from an increase in the labor force. These workers are also believed to have an opportunity cost. The free time foregone by the unemployed person to take a job on the project may be utilized very productively. He or she could be painting the house, raising children, upgrading his/her skills, etc. While these alternative activities, which would now be foregone, are thought to have some value greater than zero, this value is generally not taken to be very high. It is usually valuated at approximately one fifth of the wage rate. Thus, the opportunity cost of that portion of the work force who are assumed to be previously unemployed is equal to twenty percent of their wages.

One of the most critical issues in determining the social opportunity cost of labour is determining the effect of job creation on unemployment. The method described below is essentially that given by Haveman and Krutilla with a slight variation to allow for the value of leisure time foregone by previously unemployed persons. This method, although somewhat crude, has the advantages of being easily applied, using published data, and giving results which vary with the unemployment rate. Its major disadvantage is that it may over simplify in some cases, as no allowance is made for the effects of projects on migration and/or labour force participation. For very large projects a more refined model should be used and no single model is a substitute for reason.

Quite simply, this method postulates that the probability of a person being recruited from the pool of unemployed increases with the unemployment rate. At very high unemployment rates (Haveman and Krutilla suggest 25% or above) all persons employed on a project will be recruited from the pool of the unemployed (not necessarily directly) whereas at very low levels of unemployment no person employed will be recruited from the pool of unemployed. At very low levels of unemployment, increases in labour demand give rise solely to wage rate increases. The minimum unemployment rate (referred to as the base rate) at which no one will be hired from the pool of unemployed is determined by the period of "full employment". Haveman and Krutilla use the year 1953 for determining the base rates. DREE Atlantic proposes using the year 1966 as the base year.

Let P represent the probability of hiring a person, who is already employed. Then (1-P) would represent the probability of hiring a person from the pool of unemployed. Taking the estimate of the value of leisure time foregone by an unemployed person as 20 per cent of the wage rate (W), then the social opportunity cost of labour (SOCL) for a worker in a particular location will be given by the expression:

$$SOCL_i = P_i w_i + (1 - P_i)(.2) w_i$$
$$= (.8 P_i + .2) w_i \qquad (1)$$

where i is a subscript representing the area in which the job creation will occur.

To determine P, Haveman and Krutilla use a sine function. The expression for p is:

$$P = 1 - 0.5 \left\{ \text{Sin} \left[\pi \left(\frac{U - U^b}{U^m - U^b} \right) - \frac{\pi}{2} \right] + 1 \right\} \qquad (2)$$

where: u = actual unemployment rate in the area;
u^b = base unemployment rate for the area;
u^m = maximum unemployment rate (taken to be 0.20);
and

$\left[\pi \left(\frac{U - U^b}{U^m - U^b} \right) - \frac{\pi}{2} \right]$ is a radian value.

(The maximum unemployment, rate, taken to be twenty percent, is based on the highest level of unemployment experienced in Canada, which was 19.3% in 1933.)

Multiplying (1) by the number of persons to be employed on the project (n) gives the SOCL as a proportion of the wage bill.

Algebraically: (3)

$$SOCL = n\ (.8p_i + .2\ )\ W_i$$

Because management personnel have a significantly different employment environment than production workers, their SOCL is handled as a special case. Their better employment opportunities and their low susceptability to cyclical and structural unemployment cause us to take their full salaries as measure of their opportunity cost.

Numerical Example

A fish plant, to located in Digby, Nova Scotia, is going to employ 200 production workers. The wage rate for production workers is $9,000 per year. The production wage bill is thus $1.8 million.

In 1966, the average unemployment rate for Nova Scotia was 4.7%. This is taken to be the base unemployment rates (u_b). The actual unemployment rate in 1980 for Economic Region 23 in which Digby is located, was 10.1%. The maximum unemployment rate (u_m) is taken as 20%. Substituting into (2), we have:

$$p = 1 - 0.5 \left\{ \text{Sin} \left[\pi \left(\frac{10.1 - 4.7}{20.0 - 4.7} \right) - \frac{\pi}{2} \right] + 1 \right\}$$

$$= 1 - 0.5 \left\{ \text{Sin} \left[3.1416\ (.3529) - 1.5708 \right] + 1 \right\}$$

$$= 1 - 0.5 \left\{ \text{Sin} \left[- .4620 \right] + 1 \right\}$$

$$= 1 - 0.5 \left\{ - .4457 + 1 \right\}$$

$$= 1 - .277$$

For production workers the value of p is 0.723. From (3) we have:

$$SOCL = (200)\ [.8\ (.723) + .2]\ 9000$$
$$= (200)\ (.778)\ 9000$$
$$= \$1,400,932$$

For this example, the SOCL is approximately 78% of the wage bill.

THE SOCIAL DISCOUNT RATE

The benefits and costs of various projects will be realized over different intervals of time, and such differences in time affect evaluations of their worth to society. To make projects with different time streams commensurate, discount rates are used to convert both benefits streams and costs streams into present values. Costs and benefits occurring in future years are multiplied by a discount factor, $1/(1 + i)^y$ where i is the social discount rate per year and y is the index of the year in which the cost or benefit will occur. As y becomes larger (that is, the more remote in the future benefits and costs are), the smaller is the discount factor and hence the present value of costs and benefits. Similarly, the larger the social discount rate, i, the smaller is the present value of costs and benefits occurring in any future year. When the present value of costs and benefits are summed, a net present value figure is derived, which may be less than, equal to, or greater than zero.

The social discount rate used in this study is the opportunity cost of public funds where it is assumed that the marginal source of funds for public sector support or participation in the project is government borrowing. This borrowing tends to draw funds from various sectors of the economy depending on the extent to which these sectors are interest rate sensitive. The social discount rate is thus defined as a weighted average of the social real rates of return to capital in those sectors from which government borrowing diverts funds, the weights being the proportion of funds diverted from each sector. It has been estimated to be 10% net of inflation. This is the discount rate that the federal government uses in its economic evaluations.

EXTERNALITIES

An externality is a benefit or a cost which is not reflected in any market price. Consequently, there is no pricing signal to the generator of the externality to guide him when making decisions about production levels. An example of a beneficial externality would be an in-house training program. Company A sets up a training school for sawyers; thus, increasing the availability of sawyers to Company B. Pollution would be an example of a negative externality.

In many instances where benefit/cost analyses are carried out, externalities are of such importance that their identification and measurement are the focus of the analysis. Externalities play an essential role in the justification of

health services, educational programs, and the collection and dissemination of statistics. However, RDIA cases generally do not give rise to externalities of any significance. The main exception to this rule is pollution. As with the case of pollution, externalities are difficult to measure in real terms and even more difficult to valuate into monetary terms. It would be impossible to standardize the evaluation of externalities in a simplified way. Consequently, no effort is made in this paper to do so.

SECONDARY IMPACTS

To this point, the discussion has centered on the direct impact of the project in an attempt to determine whether the value of the real output produced by the project exceedes that of real resources consumed. A project may also have indirect impacts on the economy. These secondary impacts arise generally from the increased level of demand in the economy or from a change in the level of trade with other countries.

"Multiplier effects"

The establishment or expansion of a plant in a region of high unemployment will result in indirect job creation. The increased spending power of workers will generate regional opportunities in the consumer goods sector. Furthermore, the project may also create opportunities in industries which are either upstream or downstream in the production process. In a full employment economy, jobs created in these industries can only be filled by taking workers from other positions. Thus, there would be no net job creation. However, when unemployment exists, some jobs will trickle down to the unemployed. This indirect job creation will have two impacts. On the plus side is the benefit from the secondary production. On the negative side is the opportunity cost of the indirect labor.

Following up the potential indirect impacts of a project can be a very time-consuming effort. A short-cut approach is the use of a multiplier. A multiplier is simply a number by which the initial amount of a change in aggregate demand is multiplied to give the resulting final amount by which GNP is increased. The use of a multiplier in project evaluation represents a crude approximation. It is merely an indicator. The true value of the indirect impacts may be substantially higher or lower than that given by the multiplier.

Different multipliers exists for different purposes. The appropriate multiplier depends upon what component of aggregate demand changes initially (e.g. government spending, private investment, exports) and what is the relationship between that component and total demand. The multiplier presented here relates increased secondary production to the incremental spending in the region by the firm. As there are both benefits and costs from these indirect impacts, this multiplier incorporates a deduction for the associated opportunity costs and results in an estimate of the net benefits from the secondary impacts. The size of the

multiplier has been estimated to be .11.* This multiplier should be applied against the firm's incremental spending in the region.

Processing Plants

The standard format presented above will help in estimating the net benefit of the secondary impacts of most RDIA manufacturing proposals. However, it is recommended that special consideration be given to resource processing projects as resource extraction industries are heavily subsidized by federal and provincial programs and tax provisions. Consequently, the price of a raw resource input is likely to be well below its true economic cost. In consequence, no benefits from multiplier effects should be attributed to processing plants.

Foreign Exchange Adjustment

The foreign exchange adjustment takes into account the macroeconomic benefits and costs arising from the project. Due to national tariff and trade policy, investments which affect Canada's international balance of payments have a substantial indirect impact on our industrial structure. Quantitative modelling has demonstrated that projects which improve Canada's balance of payments also increase national economic efficiency. When a project earns more foreign exchange than it utilizes, resources in the traded sectors are released to flow towards the non-traded sector where they are used more productively. Alternatively, when a project requires more foreign exchange than it earns, resources are pulled from the non-traded sector to the traded sectors, where they are used less efficiently. In project evaluation, an adjustment to net foreign exchange flows is usually made to reflect the gains/losses in national economic efficiency

* A word of explanation. The base sector multiplier for Atlantic Canada is usually taken as 2.0. This gives the total impact on the economy of an increase in activity in the basic sector. To determine the induced and indirect impact, it is necessary to deduct the direct impact, leaving a net multiplier of 1.0. There is, of course, an opportunity cost to this indirect production which must be netted out to derive the net economic benefit from indirect production. Assuming that labor is the only idle factor of production and that the labor content of the indirect production is forty percent, then the benefit from secondary production would be the product of the labor content ratio, the net labor benefit ratio (calculated to be .28 as an average for the entire Atlantic region). and the net multiplier, i.e. .4 x .28 x 1.0 = .11

arising from the shifting of resources from one sector to another. A factor is applied against the foreign exchange earnings created by the firms export sales, and also against the savings in foreign exchange when the firm's domestic sales displace imports. The resultant figure is considered an economic benefit of the project. On the input side, the same factor is applied against the cost of foreign- sourced inputs, as well as against the cost of domestically sourced inputs which are exportable. The resultant figure is considered an indirect economic cost of the project.

The foreign exchange factor is applied against all tradables, whether or not they are actually traded. In order to apply the foreign exchange adjustment, the analyst must know what goods and services would be considered tradable. As this list is extensive, it is more practical to name those industries whose output is non-traded. These are:

- meat and dairy products,
- tobacco and tobacco products
- construction,
- utilities,
- travel, advertising and promotion,
- financial services, insurance and real estate, and
- wholesale and retail margins.

The foreign exchange adjustment factor suggested for evaluating RDIA proposals is 10%.* It should be applied against all costs and all revenues except for those related to the industries listed above. Taking into consideration both the benefit side and the cost side, the analyst should generally expect that the foreign exchange adjustment on RDIA cases will result in a net benefit in the neighbourhood of 2%-5% of sales revenue.

* The original quantitative modelling undertaken several years ago suggested a factor in the range of 13%-15%. Changing trade relations, notably the recently completed round of GATT negotiations, as well as the fact that there is a delayed response before efficiency gains are realized have caused many analysts to reduce this figure.

Section II

BENEFIT/COST CALCULATION

GENERAL ISSUES

The following chapter is less theoretical and deals with the general context and practical method in which the analysis is conducted.

Inflation - As BCA is concerned with the relative value of benefits and costs, it is preferable to ignore inflation and deal in constant dollars. The pro forma financial statements, as presented by the applicant, may or may not have incorporated inflationary effects. If so, these effects should be backed out by discounting by an appropriate inflation rate.

Time horizons - As a rule, benefits and costs should be estimated for the life of the new capital assets. The standard time horizon has been chosen to be twenty years. If this were found to be inappropriate in a particular case, this assumption should be challenged in the body of the BCA report, stating clearly the alternative assumption used and the reasoning behind it.

Discount factors - The following table of discount factors, corresponding to a ten percent social discount rate, may be used to reduce annual benefits and costs to their present value. Discount factors for up to twenty-five years are given as the construction of the plant facility may take as much as three years for larger projects.

Year	Factor	Year	Factor
Year zero	1.0000	Thirteenth year	.2897
First year	.9091	Fourteen year	.2633
Second year	.8264	Fifteenth year	.2394
Third year	.7513	Sixteenth year	.2176
Fourth year	.6830	Seventeeth year	.1978
Fifth year	.6209	Eighteenth year	.1799
Sixth year	.5645	Nineteenth year	.1635
Seventh year	.5132	Twentieth year	.1486
Eighth year	.4665	Twenty-first year	.1351
Ninth year	.4241	Twenty-second year	.1228
Tenth year	.3855	Twenty-third year	.1117
Eleventh year	.3505	Twenty-fourth year	.1015
Twelfth year	.3186	Twenty-fifth year	.0923

Locational comparisons - It is feasible to analyze the trade-off between lower operating costs in one region against the lower economic cost of labor in another by doing two BCA's of the same project, but with different locations.

INCREMENTALITY

Often, the most difficult issue to assess in an economic analysis of an RDIA case is the incrementality of the project. In order to achieve an accurate account of the economic benefits and costs arising from a project, the analyst should ensure that the figures that he uses reflect only output which is incremental to a no-project scenario.

There are two senses in which output may be considered incremental. Output may be thought incremental to the firm's existing capacity and it may also be considered as being incremental to be nation's existing capacity. Each of these incrementality issues will be dealt with separately.

In the case of a plant expansion, an increase in sales may be projected which is not totally incremental to what would have occurred in the absence of the project. The applicant may project as incremental sales all sales over and above the firm's current sales level, whereas it is more appropriate to project only those sales over and above the firm's current capacity. In the case of a modernization, there may be no increase in output, but if the project maintains sales that would otherwise have been lost, the sustained sales would be considered incremental. In both of these cases, the analyst should project a base case in which the firm does not go ahead with the project. The difference between this pro forma statement and the pro forma for the firm with the project would be the incremental impact on the firm.

In the preceding discussion, the reference point was incrementality to the firm's own output. However, the issue is broader than that. A project increases the economic wealth of the nation to the extent that it increases the country's output. However, if national output has not been increased because new production has merely displaced existing production, it follows that national welfare has not been increased. There has merely been a redistribution of economic activity. The analyst should make an attempt to reflect the impact of the project on other Canadian firms. All measures of benefits and costs which vary with output should be proportionally reduced to conform with the analyst's informed judgement as to the percentage of project output which would be truly incremental to the Canadian economy.

On what basis can the analyst determine the degree of incrementality? It may be that the incrementality factor is based solely on the subjective judgement of the analyst. If so, his assumptions should be explicitly stated in the BCA report, along with all other assumptions which affect the

results. However, some guidelines can be given. Certain products may be thought to be incremental right off the bat. These would be innovative products, import substitutes, and exports that do not compete with other Canadian exporters. In the case of such products, no incrementality factor need be used to reduce variable benefits and costs. In all other cases some adjustment should be made.

While incrementality may be an issue in the first few years of a project, it is not likely to be an issue for long. Suppose, for example, that the establishment of a new enterprise in Atlantic Canada causes the complete closure of a competitor in another region. This will mean that labor, land, capital equipment and materials will become temporarily unemployed in the other region. However, if the economy in the other region is working at anywhere near full capacity, these resources will quickly become re-employed - either through an increase in alternative markets or by redeployment of these resources into another industry. Consequently, the incremental portion of ouput will eventually rise to encompass most of the output of the project. The analyst can reflect this by increasing the incrementality factor over time. The rate of increase in the incrementality factor should reflect two particular factors; the buoyancy of the economic conditions in the other region and the adaptability of the fixed capital and labor which would be displaced. For example, if the other region has a buoyant economy, and the industry's capital and labor are flexible, then an appropriate set of incrementality factors may be (.5, .9, 1.0, 1.0, etc). On the other hand, if the other region has average economic conditions and the industry's capital and labor are not as flexible, an appropriate set of incrementality factors may be (.25, .40, .60, .75, .90, 1.0, 1.0, etc.). Finally, if the other region is a slow growth area and if the industry's capital and labor are highly specialized, an appropriate set of incrementality factors may be (.00, .00, .10, .20, .30, .40 etc). These ratios are a necessarily judgement call and must be based on some knowledge of the industry. The analyst should clearly specify his assumptions in his report and give a supporting rationale.

ASSESSMENT INDICATORS

Net economic value - After all the real impacts have been identified and valuated on a present value basis, one can obtain the net economic value (sometimes called the net present value - NPV). The net economic value is the difference between the total benefits and the total costs. Its critical value is zero. Any thing higher than this critical value means that the project would increase national welfare.

Benefit/cost ratio - A positive NPV for a project indicates that it is socially worthwhile. However, it is difficult to compare two projects on the basis of their NPV's, particularly if the two projects are on different scales. Projects are often compared on the basis of the ratio of gross benefits to gross costs. The table below compares two projects of different scales. In this example, the smaller project is relatively more beneficial to society even though it has a smaller NPV.

Scale	Gross Benefits	Gross Costs	NPV	B/C
Small	6,000,000	5,000,000	1,000,000	1.20
Large	60,000,000	58,000,000	2,000,000	1.03

Whenever a B/C ratio is derived, it is necessary that gross figures, rather than net figures be used. Otherwise, meaninglessly high ratios result. To demonstrate using the small scale example above, the ratio of totally netted benefits ($1,000,000) to totally netted costs (0) is infinity. The ratio of partially netted benefits (1,500,000) to partially netted costs (500,000) is 3:1. Thus, the same project could have dozens of different B/C ratios unless some standard method of deriving the ratio were used. Standard practice suggested here is that gross benefits be compared to gross costs.

A B/C ratio of less than one indicates that costs exceed benefits and hence the project should be rejected. Because of the nature of private sector projects, a B/C ratio greater than two is highly unlikely when gross benefits are compared to gross costs. Thus, the analyst will find that worthwhile projects have B/C ratios that fall in the range of 1.0 to 2.0.

Criteria for government assistance - RDIA grants can not be justified on economic grounds for projects whose costs exceed their benefits. A negative NPV or a B/C less than one indicates that the project would be a drain on Canada as a whole.

Net benefit/incentive ratio - In times of fiscal constraint, decision - makers may request a ranking of projects according to the yield on the incentive grants. The "bang for the buck" derived from a grant can be determined by taking the ratio of the net economic benefit of the project to the present value of the incentive grant. This net benefit/ incentive ratio should not be confused with a benefit/cost ratio. There is no particular critical value for this ratio, so long as the net economic value is positive.

However, ratios of ten to one, twenty to one, or even thirty to one are not unusual.

The net public benefits/incentive ratio describes the distributional impact of the project vis-a-vis the firm and the rest of the economy. It will be of interest to decision-makers to know how much of the net economic value is captured by the firm and how much by the economy at large. To calculate this figure, subtract the present value of the profits after taxes from the net benefits before dividing by the present value of the incentive.

WORKSHEETS

The following worksheets are presented to demonstrate the various calculations, step-by-step. Only seven years of production are presented in these tables. However, calculations should be done for twenty years of production. The bottom line of each table can be converted into present value figures by using the discount factors presented previously, and then summing.

BENEFIT-COST CALCULATION SHEET #1

VALUE OF GOODS PRODUCED

	YEAR							
	0	1	2	3	4	5	6	7
1. Sales Revenue								
2. Incrementality Factor (i.e. incremental to national production in the absence of the project)	x	x	x	x	x	x	x	x
3. Sub-Total	=	=	=	=	=	=	=	=
4. Federal and Provincial Sales Tax Receipts Where Applicable*	+	+	+	+	+	+	+	+
5. Value of Goods Produced	=	=	=	=	=	=	=	=

*See Appendix A

BENEFIT-COST CALCULATION SHEET #2

ECONOMIC COST OF LABOR

		YEAR							
		0	1	2	3	4	5	6	7
1.	Variable Labor Wage Bill								
2.	Incrementality Factor (i.e. incremental to no project scenario)	x	x	x	x	x	x	x	x
3.	Sub-Total	=	=	=	=	=	=	=	=
4.	Construction and Installation Wage Bill (Including Infra-structure)	+	+	+	+	+	+	+	+
5.	Overhead Labor Salary Bill (Excluding Management)	+	+	+	+	+	+	+	+
6.	Sub-Total Lines 3, 4 and 5	=	=	=	=	=	=	=	=
7.	Opportunity Cost Factor for Labor	x	x	x	x	x	x	x	x
8.	Sub Total Opportunity Cost of Labor	=	=	=	=	=	=	=	=
9.	Management salaries	+	+	+	+	+	+	+	+
10.	Total opportunity cost cost of labor	=	=	=	=	=	=	=	=

BENEFIT-COST CALCULATION SHEET #3

COST OF MATERIAL SUPPLIES

	YEAR							
	0	1	2	3	4	5	6	7
1. Non-Labor Variable Costs								
2. Incrementality Factor (i.e. incremental to no project scenario)	x	x	x	x	x	x	x	x
3. Sub-Total	=	=	=	=	=	=	=	=
4. Non-Labor Fixed Costs	+	+	+	+	+	+	+	+
5. Significant Government Subsidies	+	+	+	+	+	+	+	+
6. Cost of Material Supplies	=	=	=	=	=	=	=	=

BENEFIT-COST CALCULATION SHEET #4

COST OF FIXED CAPITAL

	YEAR							
	0	1	2	3	4	5	6	7
1. Buildings/Construction Materials	_____	_____	_____	_____	_____	_____	_____	_____
2. Machinery	+ _____	+ _____	+ _____	+ _____	+ _____	+ _____	+ _____	+ _____
3. Total	= _____	= _____	= _____	= _____	= _____	= _____	= _____	= _____

COST OF INFRASTRUCTURE

1. Construction Materials	_____	_____	_____	_____	_____	_____	_____	_____

COST OF LAND

1. Land	_____	_____	_____	_____	_____	_____	_____	_____

BENEFIT-COST CALCULATION SHEET #5

FOREIGN EXCHANGE ADJUSTMENT

	YEAR							
	0	1	2	3	4	5	6	7
1. Incremental Foreign Sales (or Displacement of Foreign Imports)								
2. Incremental Tradeable Inputs	-	-	-	-	-	-	-	-
3. Net Foreign Exchange Earnings	=	=	=	=	=	=	=	=
4. Foreign Exchange Adjustment Factor	x.10	x.10	x.10	x.10	x.10	x.10	x.10	x.10
5. Foreign Exchange Adjustment	=	=	=	=	=	=	=	=

BENEFIT-COST CALCULATION SHEET #6

MULTIPLIER EFFECT

		YEAR							
		0	1	2	3	4	5	6	7
1.	Total Cost of Sales								
2.	Proportion Spent in Atlantic Canada	x	x	x	x	x	x	x	x
3.	Sub-Total	=	=	=	=	=	=	=	=
4.	Net Economic Benefit Multiplier	x	x	x	x	x	x	x	x
5.	Multiplier Effect	=	=	=	=	=	=	=	=

PRESENTATION OF RESULTS

It is the analyst's task to present all the relevant information in a convenient format. Below is a suggested format for presenting the results of a benefit-cost analysis of an RDIA proposal.

Name of Firm: _____
Location: _____
Recommended Incentive: _____
(from Financial Analysis)
Present Value of recommended incentive _____

BENEFIT COST SUMMARY
(000)

Benefits	Present Value of Benefits	Costs	Present Value of Costs
Goods Produced		Fixed Capital Infrastructure Land Material Supplies	
Multiplier Effect		Labor	
Foreign Exchange Adjustment			
Total Benefits		Total Costs	

Net Economic Value _____ B/C Ratio _____ Net Economic Value/Grant Ratio _____

Net public benefit/incentive ratio _____

Section III

A CASE STUDY

DESCRIPTION OF PROPOSED PROJECT

The following case study illustrates the process of a calculating the net economic value of a project.

Background - The project involves the expansion of an existing mineral spring water bottler, Bluenose Bottlers Limited, Parrsboro, N.S. Bluenose Bottlers is an independent, privately owned, regional bottler with origins dating from 1967. Major sales outlets for the company are grocery chains and corner variety stores in the Atlantic Region. Bluenose is a profitable company with reported 1979 earnings of $1.4 million on sales of $24.6 million.

The company has not received any prior assistance under RDIA.

The Project - Growth potential for Bluenose Bottlers in the regional market is limited. Operating cost pressures resulting from the relatively small capacity of the bottling facility have led the company to search for alternate market areas which could support a substantial sales volume increase. Such an increase would allow expansion and the achievement of economies of scale on operating and overhead costs. In 1978, encouraged by favorable currency relationships, Bluenose chose to test the U.S. market, hoping to position Bluenose Canadian Mineral Water as a specialty imported soft drink product, in direct competition with such brands as Vichy and Perrier. Test market results through 1979 and the first half of 1980 are very positive, and confirm a market potential which exceeds Bluenose's earlier expectations.

To meet the rapidly growing United States demand for its products, while continuing to supply the slower growth Maritime market, Bluenose Bottlers Limited must expand its Parrsboro facility. This project involves the expenditure of $4.4 million on machinery and equipment required to increase bottling capacity from 225,000 to 350,000 barrels per year and on the construction of a tank house and well to be drilled at a site one quarter mile distant from the existing facility. This capacity will be sufficient to meet anticipated market demand for the next five years. The project will create twelve jobs directly.

Problem Areas - The viability of this project is based entirely upon an assumed penetration of the U.S. market. While volume projections are felt to be realistic, showing Bluenose's share of total U.S. mineral water imports to reach only 2.9% by 1985, the extremely competitive nature of the

U.S. soft drink market must be recognized as a significant element of risk associated with this project. It must also be noted that projections of market return have been based upon current foreign exchange relationships, which favor Canadian exporters. Should the Canadian dollar strengthen, project viability could be adversely affected.

IT&C have advised that trade relations difficulties with the U.S. are unlikely given the premium price and widespread but low market penetration associated with the Bluenose product.

Marketing - Canadian consumption of mineral water has grown rapidly in recent years. Industry volume in 1979 was 6.6% above 1978. The Maritime market, however, has continued to grow at a moderate pace. Bluenose projects continuing growth in volume of this market, with domestic sales expected to rise at an average of 3.6% per year over the next five years, without change in regional market share.

The U.S. mineral water market has seen rapid growth, doubling in total volume since 1975. This market is expected to continue to out-perform the remainder of the U.S. soft drink sector, growing at a 10% annual rate through to 1985. U.S. imports in 1979 were 2.1 million barrels, 2% of the estimated total U.S. market of 100 million barrels.

After eighteen months of test market work, Bluenose Canadian Mineral Water is already available in 28 states, through 450 sales outlets, and holds a .5% share of U.S. imports. Distribution of the Bluenose product in the U.S. is handled on an exclusive basis by Thomas Importers. Thomas Importers handle Sussex Ltd. products, Moffat's Australian eucalyptus juice, and Mont Calme mineral water, in addition to Bluenose. With strong national distribution already in place, together with maintenance of a specialty product image in advertising and packaging, Bluenose expects significant increases in sales volume to the U.S. Projected 1985 volume is 99,000 barrels, representing a 2.9% share of estimated U.S. imports in that year.

Production process - The Parrsboro facility is a conventional bottling operation, now approaching its capacity limit. Proposed process changes include major modifications to the packaging lines to accommodate a more attractive style bottle (a design different from the Canadian standard), the addition of carton forming and packing equipment suited to the U.S. six-pack, market format, and installation of coding equipment which meets U.S. labelling requirements. A second production well will be drilled at a site one quarter mile from the present facility. The mineral water will be trucked

to the bottling plant. All process changes involve the use of proven technology and conventional equipment.

Resources and availability - Raw materials required are mineral water, glass bottles, metal crowns, labels, cartons, and pallets. No particular difficulty in obtaining reasonable priced raw materials and supplies is foreseen. The mineral water will be obtained from a spring on land purchased by the company in 1976. Test drilling has determined that the spring could produce 150,000 barrels annually indefinitely. The combined capacity of the new and the existing spring wells would be 370,000 barrels.

The project will have a positive impact on Bluenose's maritime suppliers, generating substantial export sales of glass bottles and packaging materials manufactured in the region. Local operating supply purchases attributed to the project will reach $6 million annually by 1985.

Labour requirements and availability - The project will create 12 full time jobs. All positions can be filled locally without difficulty.

BLUENOSE BOTTLERS LIMITED
PRO FORMA INCOME STATEMENT FOR SALES ADDITIONAL TO CURRENT LEVEL
(Constant $000's)

	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Increased Sales	3,130	7,566	10,780	13,995	17,209	20,575
Variable Cost of Sales	2,913	6,657	9,739	11,977	14,648	17,513
Gross Profit	217	909	1,041	2,018	2,561	3,062
Fixed Overhead	60	140	300	540	620	620
Profit before Depreciation, Interest and Taxes	157	769	741	1,478	1,941	2,442

OTHER RELEVANT FINANCIAL PROJECTIONS
(Constant $000's)

	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4
Fixed Capital Costs					
Construction Materials	200	360			
Cost of Machinery	635	2,195			
Wage Bill*					
Construction Labor	110	240			
Installation Labor	63	271			
Operating Costs					
Variable Labor	0	160	185	216	216

* Includes wage benefits.

HISTORICAL AND PROJECTED SALES VOLUMES
(in barrels = 35 Imperial Gallons)

Year	Domestic	Export	Total
Actuals			
1977	167,592	0	167,592
1978	174,633	0	174,633
1979	192,201	10,652	202,763
Projections			
1980	201,800	21,400	223,200
1981	211,800	40,400	252,200
1982	218,200	55,000	273,200
1983	224,800	69,400	294,200
1984	231,200	84,000	315,200
1985	238,200	99,000	337,200

constant thereafter

Total Increased Sales

Year	Domestic	Export	Total
1980	9,599	10,838	20,437
1981	19,599	29,838	49,437
1982	25,999	44,438	70,437
1983	32,599	58,838	91,437
1984	38,999	73,438	112,437
1985	45,999	88,438	134,437

Current bottling capacity is 225,000 barrels. Projected capacity after expansion will be 350,000 barrels. As some of the increased sales can be met by existing capacity, the company was asked to provide a pro forma income statement for incremental sales only. Furthermore, export sales involve different benefits and possibly different costs to Canadians than domestic sales. The company was asked to break out the separate markets in the income statement. Revenue from sales were allocated to Americans sales and Canadian sales on the assumption that no Canadian sales would be bottled on the new machinery until the current bottling capacity was met. This is not unreasonable, as the new machinery is required to handle the American style bottle. The company provided the following revised financial information.

BLUENOSE BOTTLERS LTD.

INCREMENTAL SALES PROJECTIONS

Year	Domestic	Export	Total
1980	0	0	0
1981	0	27,200	27,200
1982	0	48,200	69,200
1983	0	69,200	69,200
1984	6,200	84,000	90,200

Incremental
Pro Forma Income Statement
($000 Constant)

	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Incremental Sales						
Total	0	4161	7330	10,636	13,767	17,077
American	0	4161	7330	10,636	12,828	15,077
Canadian	0	0	0	0	939	2,000
Variable Cost of Sales Total	0	3661	6623	9,103	11,718	14,536
re. American	0	3661	6623	9,103	10,933	12,931
re. Canadian	0	0	0	0	785	1,605
Gross Incremental Profit	0	500	707	1,533	2,049	2,541
Fixed Overhead	0	77	204	410	496	515
Profit before Depreciation, Interest and Taxes	0	423	503	1,123	1,553	2,026
Net Profit	324	1,168	(178)	(15)	157	499

Financial Analysis

Prior to a BCA, the project proposal was analyzed financially. The expansion was seen to be viable, giving a 17.6% percent return on investment without an incentive and a 19.9% percent return with the proposed incentive of $876,000, of which $701,000 would be distributed in the second year and the remaining $175,000 in the fourth year. Net profit to the firm was estimated to have a present value of $4.02 million over the expected twenty year life of the assets.

DISCUSSION

The analysis uncovered a number of issues. The following discussion demonstrates how each was dealt with.

Value of goods produced - The product is of sufficient value to consumers to bear the federal twelve percent manufacturing sales tax, in the case of exports, and an additional eight percent provincial retail sales tax in the case of domestic sales. (The provincial tax is added on top of the federal tax so the total tax burden on domestic sales is 21% and not 20%.) Besides these taxes, the value of goods produced includes, of course, the revenue generated from sales.

Incrementality of output - The firm is expected to just maintain its market share of the slowly growing local market. So it would not displace other Canadian producers. Foreign sales were thought totally incremental to other Canadian producers. This may not be an appropriate assumption, as the product would compete somewhat with that of MontCalme Bottlers of Quebec City who are also attempting to penetrate the American market. On the other hand, the two producers may help one another penetrate the American market by creating jointly a positive Canadian image for mineral water. It would be impossible to determine which effect would dominate. As both effects seemed rather minor, they were ignored.

Multiplier effect - The firm estimates that in 1981 they would spend $1.5 million more in the region than they would otherwise. By 1985, this would rise to $6.0 million. For both years, this equals about forty percent of the total cost of sales. This ratio was interpolated for the intervening years when determining the base for the multiplier.

The foreign exchange adjustment factor was applied against all domestic sales, as well as against all exports, as the former were thought to displace foreign imports. On the

input side, the adjustment factor was applied against the sum of the cost of machinery, the variable cost of sales and fixed overhead. Including the entire cost of sales is probably an overestimate of the value of the tradable inputs. However, a break-out of the cost of utilities, travel, advertising, etc. was not available. In the case of a soft drink product, advertising represents a large proportion of variable costs. Generally, the foreign exchange adjustment factor is not applied against such costs. However, in this example, the advertising would obviously be purchased in the U.S.A. Here, common sense dictates that the adjustment factor be applied against it anyway. Consequently, the estimate of the net foreign exchange benefit may not be overly conservative.

Incrementality of labor - All staff hirings projected in the original submission were attributed to the expansion facilities. Company officials report that present staffing is adequate for handling the full output from current capacity.

Economies of scale were evident in that the existing warehouse is sufficient to meet 1985 turnover volumes and in the fact that operating costs and fixed overhead would increase less than proportionally.

Government subsidies - the only hidden subsidy thought significant enough to bother calculating related to energy costs - a heavily subsidized input. Historically, the financial cost of fuel and electricity to the firm has been about five percent of the variable cost of sales. As energy costs are thought to be currently underpriced by fifty percent, the cost of material supplies was adjusted upwards by this five percent figure.

Land - The new well site is on land purchased by the firm in 1976 for $75,000. This land could be sold for an alternative productive use. Consequently, a current market price of $110,000 was imputed to it.

Environmental considerations - Bottling mineral water is a mechanical process with no environmentally harmful by-products. The non-returnable bottles, which could produce a litter problem, are all to be exported and would not affect Canadian surrounds.

These were the issues addressed. The actual calculations follow.

BENEFIT-COST CALCULATION SHEET #1

VALUE OF GOODS PRODUCED

(000'S)

		YEAR							
		0	1	2	3	4	5	6	7
1.	Sales Revenue	0	4,161	7,330	10,636	13,767	17,077	17,077	17,077
2.	Incrementality Factor (i.e. incremental to national production in the absence of the project)	x 1	x 1	x 1	x 1	x 1	x 1	x 1	x 1
3.	Sub-Total	= 0	=4,161	=7,330	=10,636	=13,767	=17,077	=17,077	=17,077
	of which								
	- Foreign is	0	4,161	7,330	10,636	12,828	15,077	15,077	15,077
	Canadian is	0	0	0	0	939	2,000	2,000	2,000
4.	Federal and Provincial Sales Tax Receipts Where Applicable	FOR 0	499	880	1,276	1,539	1,809	1,809	1,809
		CAN 0	+ 0	+ 0	+ 0	+ 84	+ 419	+ 419	+ 419
5.	Value of Goods Produced	= 0	=4,660	=8,210	=11,912	=15,390	=19,305	=19,305	=19,305

BENEFIT-COST CALCULATION SHEET #2

ECONOMIC COST OF LABOR

(000'S)

	YEAR							
	0	1	2	3	4	5	6	7
1. Variable Labor Wage Bill	0	160	185	216	216	216	216	216
2. Incrementality Factor	x 1	x 1	x 1	x 1	x 1	x 1	x 1	x 1
3. Sub-Total	= 0	= 160	= 185	= 216	= 216	= 216	= 216	= 216
4. Construction and Installation Wage Bill (Including Infra-structure)	+ 173	+ 511	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0
5. Overhead Labor Salary Bill (Excluding Management)	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0
6. Sub-Total Lines 3, 4 and 5	= 173	= 671	= 185	= 216	= 216	= 216	= 216	= 216
7. Opportunity Cost Factor for Labor	x .83	x .83	x .83	x .83	x .83	x .83	x .83	x .83
8. Sub-Total Opportunity Cost of Labor	= 144	= 557	= 154	= 179	= 179	= 179	= 179	= 179
9. Management Salaries	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0
10. Total Opportunity cost of labor	= 144	= 557	= 154	= 179	= 179	= 179	= 179	= 179

BENEFIT-COST CALCULATION SHEET # 2a

Social Opportunity Cost Factor for Labor

U = average actual 1980 unemployment rate in economic region 22 in which Parrsboro is located = 9.3%

U_b = base unemployment rate for Nova Scotia (1966) = 4.7%

U_m = maximum unemployment rate (taken to be 0.20)

$$p = 1 - .5 \left\{ \sin \left[\pi \left(\frac{U - U^b}{U^m - U^b} \right) - \frac{\pi}{2} \right] + 1 \right\}$$

$$= 1 - .5 \left\{ \sin \left[\pi \left(\frac{9.3 - 4.7}{20.0 - 4.7} \right) - \frac{\pi}{2} + 1 \right\} \right.$$

$$= .793$$

SOCL rate = (.8p + .2)

= .83

BENEFIT-COST CALCULATION SHEET #3

COST OF MATERIAL SUPPLIES

(000'S)

		YEAR							
		0	1	2	3	4	5	6	7
1.	Variable Costs Excluding Labor	0	3,501	6,438	8,887	11,502	14,320	14,320	14,320
2.	Incrementality Factor	x 1	x 1	x 1	x 1	x 1	x 1	x 1	x 1
3.	Sub-Total	= 0	=3,501	=6,438	= 8,887	=11,502	=14,320	=14,320	=14,320
4.	Non-Labor Fixed Costs	+ 0	+ 77	+ 204	+ 410	+ 496	+ 515	+ 515	+ 515
5.	Significant Government Subsidies	+ 0	+ 183	+ 331	+ 455	+ 586	+ 727	+ 727	+ 727
6.	Cost of Material Supplies	+ 0	+3,761	+6,973	+ 9,752	+12,584	+15,562	+15,562	+15,562

BENEFIT-COST CALCULATION SHEET #4

COST OF FIXED CAPITAL

(000'S)

	YEAR							
	0	1	2	3	4	5	6	7
1. Buildings/Construction Materials	200	360	0	0	0	0	0	0
2. Machinery	+ 572	+1,924	+ 0	+ 0	+ 0	+ 0	+ 0	+ 0
3. Total	= 772	=2,284	= 0	= 0	= 0	= 0	= 0	= 0

COST OF INFRASTRUCTURE

1. Construction Materials	0	0	0	0	0	0	0	0

COST OF LAND

1. Land	110	0	0	0	0	0	0	0

BENEFIT-COST CALCULATION SHEET #5

FOREIGN EXCHANGE ADJUSTMENT

(000'S)

	YEAR							
	0	1	2	3	4	5	6	7
1. Incremental Foreign Sales (or Displacement of Foreign Imports)	0	4,161	7,330	10,636	13,767	17,077	17,077	17,077
2. Incremental Tradeable Inputs	- 572	-5,662	-6,827	- 9,513	-12,214	-15,051	-15,051	-15,051
3. Net Foreign Exchange Earnings	= 572	=1,501	= 503	= 1,123	= 1,553	= 2,026	= 2,026	= 2,026
4. Foreign Exchange Adjustment Factor	x .10	x .10	x .10	x .10	x .10	x .10	x .10	x .10
5. Foreign Exchange Adjustment	= 57	= 150	= 50	= 112	= 155	= 203	= 203	= 203

BENEFIT-COST CALCULATION SHEET #6

MULTIPLIER EFFECT

		YEAR							
		0	1	2	3	4	5	6	7
1.	Total Cost of Sales	0	3,738	6,827	9,513	12,214	15,051	15,051	15,051
2.	Proportion Spent in Atlantic Canada	x 0	x .40	x .40	x .40	x .40	x .40	x .40	x .40
3.	Sub-total	= 0	= 1,495	= 2,731	= 3,805	= 4,886	= 6,020	= 6,020	= 6,020
4.	Net Benefit Multiplier (Atlantic Region)	x .11	x .11	x .11	x .11	x .11	x .11	x .11	x .11
5.	Multiplier Effect	= 0	= 164	= 300	= 419	= 537	= 662	= 662	= 662

PRESENTATION OF ANALYSIS

The following is an example of the report which may appear before the Incentives Board.

BENEFIT-COST ANALYSIS

Bluenose Bottlers, bottlers of Bluenose mineral water propose to increase production and sales by drilling a second well, increasing bottling capacity and entering the American market. The net economic benefit from of this expansion is estimated to have a present value of $25.9 million. The B/C ratio of 1.23 is good for a manufacturing project. The NEV/grant ratio of almost 37:1 indicates that the government will generate a significant bang for the buck that it invests in this project.

Incrementality of output - The firm is not expected to displace other Canadian producers as production is mainly for export and export sales will be incremental to Canadian production.

Tax Generation - The project is expected to generate $15 million in sales taxes, most of this being the federal manufacturer's sales tax. The project is also expected to generate about $3 million in corporate income taxes, which may be compared to the $4 million in after tax profit that the firm is projected to achieve.

Economies of scale were evident in that the existing warehouse is sufficient to meet 1985 turnover volumes and in the fact that operating costs and fixed overhead would increase less than proportionally. The measure of these economies is implicit in the net economic benefit.

Government subsidies - Energy costs, which are approximately five percent of the variable cost of sales, were doubled to reflect government subsidization of oil imports and electrical generation.

Environmental considerations - Bottling is a mechanical process and no environmentally harmful by-products are produced. The non-returnable bottles, which could produce a litter problem, are all to be exported and would not affect the Canadian landscape.

Benefit to labor - In comparison to the net economic value of the project, the net benefit accruing to labor is small, being approximately $408,000. Rather than appearing

as a separate item on the summary sheet, it shows up as a decrease in the economic cost of labor.

Indirect benefits - Standard adjustments were made to reflect the benefits arising from secondary economic activity that would be stimulated by the project. These are the foreign exchange adjustment and the multiplier effect. The figure of $5,737,000 represents the net benefit once all economic costs of secondary economic activity have been taken into account.

Name of Firm: Bluenose Bottlers
Location: Parrsboro, N.S.
Recommended Incentive: $876,000
(from Financial Analysis)
Present Value Incentive $699,000

BENEFIT COST SUMMARY
(000)

Benefits	Present Value of Benefits	Costs	Present Value of Costs
		Fixed Capital	3,157
Goods Produced (Including Taxes Raised)	133,641	Infrastructure	0
		Land	110
		Material Supplies	108,261
Multiplier Effect	4,614	Labor	1,992
Foreign Exchange Adjustment	1,123		
Total Benefits	139,378	Total Costs	113,520

Net Economic Value $25,858 B/C Ratio 1.23 Net Economic Value/Grant Ratio $\frac{25,858}{699} = 37$

Net public benefit/incentive ratio $\frac{25,858 - 4,023}{699} = 31$

On the following page are brief descriptions of each of these four indicators, detailing how and when each may be useful to decision-makers.

ASSESSMENT INDICATORS

Net economic value - The net economic value is the difference between the total benefits and the total costs. Its critical value is zero. Any thing higher than this critical value means that the project would icrease national welfare.

Benefit/cost ratio - A positive NPV for a project indicates that it is socially worthwhile. However, it is difficult to compare two projects on the basis of their NPV's, particularly if the two projects are of different scales. Projects are often compared on the basis of the ratio of gross benefits to gross costs. A B/C ratio of less than one indicates that costs exceed benefits and hence the project should be rejected. Because of the nature of private sector projects, a B/C ratio greater than two is highly unlikely when gross benefts are compared to gross costs. Thus, worthwhile projects will have B/C ratios that fall in the range of 1.0 to 2.0.

Net benefit/incentive ratio - The B/C ratio should be used to rank projects when the constraint on capital is the capital market. However, in times of fiscal constraint, decision - makers may request a ranking of projects according to the yield on the incentive grants. The "bang for the buck" derived from a grant can be determined by taking the ratio of the net economic benefit of the project to the present value of the incentive grant. This net benefit/incentive ratio should not be confused with a benefit/cost ratio. There is no particular critical value for this ratio, so long as the net economic value is positive. Ratios of ten to one, twenty to one, or even thirty or forty to one are not unusual. This ratio is appropriately used to rank projects when a ceiling is set on the total value of incentive grants in a budget year.

The net public benefits/incentive ratio describes the distributional impact of the project vis-à-vis the firm and the rest of the economy. It will be of interest to decision-makers to know how much of the net economic value is captured by the firm and how much by the economy at large.

APPENDIX A

FEDERAL AND PROVINCIAL TAXES ON CONSUMPTION

The following is a digest of information available from Principal Taxes in Canada (Stats. Can. Cat. 68-201E). This was discontinued after 1978. The information provided will help the analyst derive the ultimate value to consumers of various manufactured goods. As explained in the text, the final value of goods produced includes all consumption taxes paid directly or indirectly by the consumer.

FEDERAL CONSUMPTION TAXES

The federal government levies consumption taxes pursuant to various Acts of which the most important for our purposes are the Excise Tax Act and the Excise Act. The main taxes levied under each of these Acts are briefly described below.

The Excise Tax Act

(a) Consumption or Sales Taxes

The main component of the excise tax structure is the general manufacturers sales tax. Under Part V of the Excise Tax Act, the federal government levies a tax on all goods produced in or imported into Canada unless there is a specific exemption in the Act. For goods produced in Canada, the taxable value is the selling price of the manufacturer, or, under certain conditions, the purchase price of a licensed wholesaler or operator of duty-free sales outlets. The rate is 9% on most commodities; it is 5% on building equipment and construction materials which are specified in Schedule V of the Act.

Articles exempted by the Act include:

Covering of containers; diplomatic articles; educational material; farm and forest products; foodstuffs; fuel and electricity; health material; marine and fisheries items; mines and quarries material; municipalities; production equipment, processing materials and plans; goods manufactured in institutions; clothing and footwear; construction equipment; transportation equipment; insulation material and some miscellaneous items.

(b) Excise Taxes

In addition to the sales tax, the Excise Tax Act also imposes a number of special excise taxes. These consist of ad valorem taxes levied on the same price or duty-paid values as the general sales tax and of specific taxes on certain products.

Most commodities subject to the sales tax described above are also subject to the excise tax. These commodities or articles are specified in Part III and IV of the Act as well as in the schedule to the Act. Most of these articles are listed in Table I. The excise tax and the consumption tax are calculated independently on the basic value of the product which is the sale or delivered price when made in Canada. For alcoholic beverages and tobacco products the sale price, for the purpose of the excise taxes, includes the excise duties levied under the Excise Act. The excise tax does not apply to exported goods.

TABLE I

BASIS AND RATES OF FEDERAL EXCISE TAXES

Part III, articles enumerated in Schedule 1:

Lighters	$ 0.10 per unit
Amusement devices	10% ad valorem
Smokers accessories	10% " "
Cigars	21½% " "
Matches	10%
Clocks and watches (portion over $50)	10%
Jewellery, previous or semi-precious stones	10%
Automobiles:	
4,425-4,525 lb. (portion)	$ 30
4,525-4,625 lb. (portion)	40
4,625-4,725 lb. (portion)	50
Each additional 100 lb.	60
Station-wagons, vans and trucks:	
5,000-5,100 lb. (portion)	$ 30
5,100-5,200 lb. (portion)	40
5,200-5,300 lb. (portion)	50
Each additional 100 lb.	60
Motorcycle (displacement greater then 250 c.c.)	5
Boats and motors exceeding 20 h.po	10%
Private aircraft	10
Gasoline	$ 0.10 per gal.
Air conditioner for motor vehicles	$100

Part III, articles enumerated in Schedule II:

Cigarettes	$ 0.03	per 5
Tobacco-manufacture	0.90	per pound

Part IV:

Playing cards	0.20	per pack
Wines containing 7% or less alcohol	0.25	per gallon
Non-sparkling wines containing more then 7% alcohol but not over 40% proof spirit	0.50	per gallon
Champagne and all other sparkling wines	2.50	" "
Additional levy (applied to domestic and imported wines):		
Wines containing 7% or less alcohol	0.025	" "
Wines containing more than 7% alcohol	0.05	" "

The Excise Act

Under This Act, the federal government levies duties on tobacco and alcoholic products, other than wines, made in Canada. These commodities are under the control of the Crown until the duty is paid and evidenced by a stamp or an approved imprint placed on the article. The duties are expressed at various unit rates based on the quantity rather than the value of the product and are applied before the above-mentioned excise taxes are levied.

TABLE II

BASIS AND RATES OF FEDERAL EXCISE DUTIES

(a) Spirits:

Domestic potable spirits on the strength of proof distilled in Canada	$ 15.25	per gallon
Non-potable spirits used in the manufacture of:		
Medicines, extracts, pharmaceutical preparations, etc.	1.50	" "
Approved chemical compositions	0.15	" "
Spirit sold to druggist for preparation of prescriptions	1.50	" "
Imported spirits taken into bonded manufactory in addition to other duties	0.30	" "
Canadian brandies	14.25	" "
Beer	0.42	" "

(b) Tobacco - On domestic production:

Manufactured tobacco excluding cigarettes	0.50 per pound
Cigarettes weighing not more than 3 lb. per 1,000	5.00 per 1,000
Cigarettes weighing more than 3 lb. per 1,000	6.00 per 1,000
Cigars	2.00 per 1,000
Canadian raw leaf tobacco when sold for consumption	0.10 per pound

PROVINCIAL RETAIL SALES TAX

All provinces, except Alberta, tax at the retail level a wide range of consumer goods and services purchased in or brought into the province. The tax is payable on the selling price of tangible personal property, defined to include certain services purchased for own consumption or use and not for resale. Each provincial Act, however, specifies a number of goods that are exempt and variations exist among provinces. Generally, these exemptions include:

- food and food products for human consumption (except confections and soft drinks);
- clothing and footwear;
- farm implements, machinery and supplies; fertilizer; chemical controls; and drainage tiles;
- boats, equipment and apparatus for commercial fishing;
- drugs and medicaments;
- educational and published material;
- certain transportation equipment
- goods for manufacture;
- insulating materials;
- one-half the sale price of mobile homes; and lastly
- funeral caskets.

The current general retail sales tax rates are:

Newfoundland	11%
Prince Edward Island	10%
Nova Scotia	8%
New Brunswick	8%
Quebec	8%
Ontario	8%
Manitoba	5%
Saskatchewan	5%
Alberta	0%
British Columbia	5%

PROVINCIAL TAXES ON ALCOHOLIC BEVERAGES

Provincial governments derive substantial amounts of revenue through the sale of alcoholic beverages by provincial agencies operating as boards or commissions which exercise monopolistic control over the distribution of these products. The markups of these agencies are tantamount to taxation and vary with types of products. They are not publicized and so are not reported here. In certain provinces, beer and/or wine are sold by private retailers as well as by liquor board or commission outlets. In the case of private retailers, licence and other fees are substituted for government markups. In addition to the markups, sales to individuals are subject to the retail sales tax in most provinces.