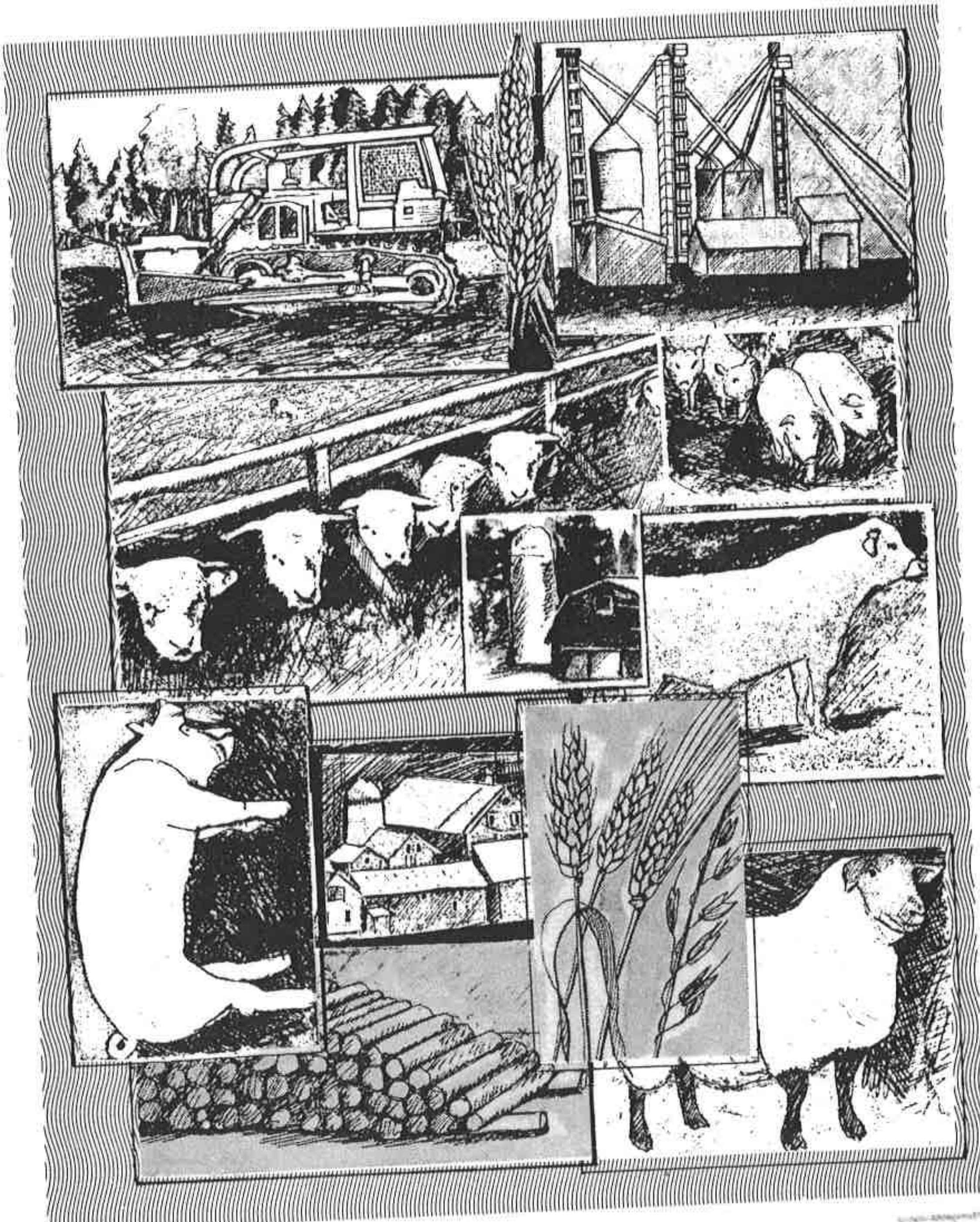
SUBSIDIARY AGREEMENT AGRICULTURE DEVELOPMENT

INTERIM ECONOMIC EVALUATION



GARDNER PINFOLD
consulting economists

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AGRICULTURE DEVELOPMENT

Interim Economic Evaluation

December, 1980

GARDNER PINFOLD Consulting Economists
P.O. Box 3120, Halifax South Postal Station,
Halifax, Nova Scotia, Canada B3J 3G6
Telephone: (902) 423-1269

January 7, 1981

Mr. Arnold Rovers, Director
Marketing and Economics
Department of Agriculture and
Marketing
P.O. Box 550
Truro, Nova Scotia
B2N 5E3

Dear Mr. Rovers:

On July 15th, 1980, the Department of Agriculture and Marketing retained the services of Gardner Pinfold, Consulting Economists to undertake an interim economic evaluation of programmes and projects carried out under the Subsidiary Agreement on Agriculture, 1976.

We are pleased to submit herewith our final Report.

We wish to extend our thanks to you and other members of the Evaluation Committee for your assistance in the production of this Report. We have enjoyed this assignment very much.

Respectfully submitted,

M. Gardner
Project Director

ACKNOWLEDGEMENTS

This study was commissioned by the Agriculture Development Task Force and was funded jointly by the Department of Regional Economic Expansion and the Province of Nova Scotia.

The Task Force consists of the following representatives:

Mr. Arnold Rovers, Department of Agriculture and Marketing, Province of Nova Scotia;

Mr. John Chesley, Department of Regional Economic Expansion, Government of Canada

Mr. Campbell Gunn, Agriculture Canada, Government of Canada;

Ms. Margaret Hambleton, Department of Development, Province of Nova Scotia;

Mr. George Dargie, Department of Regional Economic Expansion, Government of Canada.

We would like to express our sincere thanks to the members of the Task Force for their assistance at the outset of the study and for their guidance and helpful comments throughout the exercise.

We relied very heavily on data provided by officials of the Department of Agriculture and Marketing in carrying out this study. These officials are too numerous to mention by name. We wish to express our appreciation for the hours they spent enlightening us on the operations of many aspects of the Agricultural Sector. A debt of gratitude is owed Mr. Jamie Oxley of Agriculture Canada whose efforts in compiling and analyzing survey data on participants in the various incentive programmes proved most helpful.

The involvement of the aforementioned individuals and departments does not implicate them in any errors or omissions which may remain. They are the responsibility of the authors.

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EXECUTIVE SUMMARY

1. Purpose

The general purpose of this Report is to provide an interim evaluation of the programmes and projects implemented between 1976 and 1979 under the Canada-Nova Scotia Subsidiary Agreement, Agriculture Development signed under the Canada/Nova Scotia General Development Agreement.

2. Approach

The programmes and projects have been evaluated in terms of their economic viability and their economic impact on the Province of Nova Scotia. Viability has been established in terms of economic efficiency using conventional cost-benefit or cost-effectiveness analysis, as deemed appropriate. The economic efficiency criterion provides the decision-maker with guidance as to whether the resources committed to a particular project are used in a way that is at least as productive as their best alternative use.

Economic impact in terms of the income and employment generated by the various programmes was measured and reported in aggregate form. This type of assessment provides a useful perspective from which to view projects but does not, in and of itself, provide an adequate criterion on which to accept or reject a project. Whereas the economic efficiency analysis was carried out using national parameters (e.g., discount rate), the economic impact assessment was undertaken from the vantage point of the Nova Scotia economy.

The third step in our evaluation was to undertake an overall assessment of the programmes and projects in the context of General Development Agreement objectives. This assessment was qualitative in nature.

3. Cost-Benefit Analysis

Sixteen programmes/projects were analyzed, although for reasons of data deficiency, a detailed cost-benefit analysis was possible for twelve only. A summary of the results is set out in Table ES-1. The period of analysis in each case was 20 years (with the exception of tree fruits where a 30 year period was considered more appropriate) using a real discount rate of 10 percent. All calculations were carried out in constant dollar terms using a 1978 base year. Although the net present values and benefit-cost ratios have been calculated and reported for each programme/project in the text, only the benefit-cost ratios appear in Table ES-1.

Our analysis indicates that nine of the twelve programmes/projects examined in detail can be considered acceptable from an economic perspective. Those programmes/projects whose benefit-cost ratios equal or exceed 1.0 can be expected to earn an economic rate of return at least equal to the social opportunity cost of capital in this case estimated at 10 percent. This means that the resources committed to those programmes/projects have been used in a way which is at least as productive as their best alternative use when viewed from the perspective of society as a whole.

4. Results

4.1 Land Clearing and Improvement

The Land Development Programme, comprised of land clearing and improvement activities, is regarded as a foundation for other projects in the Subsidiary Agreement. The overall objective of the Programme is to increase

Table ES-1

Summary of Evaluation Results
Benefit-Cost Ratios and Incrementality

Project	Benefit-Cost Ratio	Incrementality[4] (percent)
1. Land Clearing and Improvement		
a) Clearing[1]	.85 to 1.07	80
b) Improvement[1]	1.03 to 1.2.	
2. High Energy and Protein Crop Incentive		
a) Feed Replacement	1.10	73
b) Cash Crop	1.01	
3. Feed Facility Incentive		
a) Drying, Milling, Storing[1]	.92 to 1.33	
b) Hay Drying	6.45	33
c) Silos2	n.a.	
4. Central Grain Storage Unit	.54	100
5. Beef Production Incentive	.90	43
6. Hog Production Incentive	1.01	54
7. Sheep Production Incentive	1.02	30
8. Purebred Sheep Breeding Stock Incentive[3]	-	-
9. Manure Storage Development Incentive	1.20	45
10. Tree Fruit Incentive	.91 to .99	99
11. Bulk Bin Construction	2.47	-
12. Refrigerated Containers	1.32	-
13. Greenhouse Incentive	1.02	-
14. Marketing Facilities[3]	-	-
15. Technology Adoption[3]	-	-
16. Innovative Demonstration[3]	-	-

Note: 1. range of BCR indicates that alternative cases were used to evaluate programme.

2. project evaluated using cost-effectiveness technique, hence no BCR is available.

3. there was insufficient data to carry out quantitative analysis.

4. indicates proportion of participants who would not have undertaken work without the incentive.

the area and the productive capacity of the agricultural land base in Nova Scotia. This is to be achieved through the provision of assistance grants to farmers. Over the five-year life of the Programme, it was anticipated that 50,000 acres would be cleared and another 50,000 acres improved at an estimated total cost of $26 million. To date a total of 21,988 acres have been cleared and another 24,284 acres have been improved.

In general, the method used in the Cost-Benefit Analysis of the Land Development Programme follows the approach outlined in Chapter Two. The incremental capital and operating costs and revenues were estimated using historical data and by simulating the cost and revenue impacts of bringing land into production using different cropping patterns. The results of the Cost-Benefit Analyses for land clearing and improvement activities depend very much on the cropping pattern used as the basis for analysis. In the case of land clearing the Benefit-Cost Ratios range from .85 to 1.07, indicating the relative viability of three different rotations. The Benefit-Cost Ratios for the land improvement project range from 1.03 to 1.21 over four different rotations. As a general conclusion, it can be stated that from a socio economic perspective the Land Development Programme has been worthwhile and will make a positive contribution to the viability of the agricultural sector in Nova Scotia.

4.2 <u>High Energy and Protein Crop Incentive</u>

The High Energy and Protein Crop Incentive Programme is linked directly to programmes designed to expand the agricultural land base and, as well, to the expansion of livestock numbers in the Province. The primary objective of this Programme is to promote increased production of high energy and protein crops with a target of 36,000 additional acres of grain production stated. The estimated five-year cost of the Programme was $2.75 million. To date 9,678 additional acres of grain have been brought into production. This Programme has attracted as many as 20 percent repeat participants.

The method used in the Cost-Benefit Analysis of the Crop Incentive Programme adheres generally to the conventional approach. As a slight deviation from the conventional approach, four cases are built around a single grain rotation. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the production from 44 additional acres of grain land over the twenty-year evaluation period. The results of the Cost-Benefit Analysis of the Crop Incentive Programme indicate that from the point of view of society the Programme has been worthwhile. The Benefit-Cost Ratios generated range from 1.01 to 1.10 indicating that discounted benefits exceed discounted costs.

4.3 Feed Facility Incentive

The purpose of the Feed Facility Incentive Programme is to encourage the establishment of on-farm facilities for drying, storing and milling grain, for drying livestock fodder and for storing silage and high moisture grain. This Programme is linked with the Crop Incentive Programme in that it was expected that one-half of the target acreage would be stored or processed in facilities constructed under the Feed Facility Incentive. The anticipated five-year cost of the Programme was $5.4 million. Given the aggregated and general nature of the Annual Report data it was not possible to determine whether the target with respect to grain acreage stored had been achieved. However, from an expenditure point of view, it would appear that the five-year objective had been met after four years.

The Cost-Benefit Analysis of the Feed Facility Incentive involved the examination of three different facilities:

a) silos - vertical and horizontal
b) grain drying, milling and storing
c) hay driers

In general, parts (b) and (c) conform to the conventional Cost-Benefit Analysis outlined in Chapter II. The analysis of vertical and horizontal silos was conducted from a cost effectiveness perspective using the traditional small bale handling system as a sort of "yard stick." Various tonnages of hay or silage were handled and fed by the different systems and compared using this approach.

The small bale system was found to be cost-effective for handling 100 tonnes, horizontal silos for handling 250 and 500 tonnes, and vertical silos for 750 tonnes handled.

The results of the Cost-Benefit Analysis for grain drying, milling and storing facilities are very much dependent on the farmer's decision whether or not to include a grain drier as part of the investment. From society's perspective the project is worthwhile if grain driers are not included in the on-farm feed facility. The additional cost of the drier reduces the Benefit-Cost Ratio from 1.33 to .92.

The case of the hay drier is clear-cut. Socio-economically the project appears to be viable as witnessed by a Benefit-Cost Ratio of 6.45.

4.4 Central Grain Storage Unit

The Central Grain Storage Unit was designed to provide drying, storage and handling capacity for part of the increased grain production derived from the land clearing and crop incentive programmes. The storage unit, which began operation in July, 1978, is located in Steam Mill, just outside Kentville in Kings County. The facility has a storage capacity of 2,500 tonnes and a maximum throughput capacity (cleaning and drying) of approximately 3,500 tonnes per month.

The method used in the Cost-Benefit Analysis of the Central Grain Storage Unit conforms to the conventional approach outlined in Chapter Two. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the operation of the facility over the twenty year evaluation period. The results of the Cost-Benefit Analysis of the Central Grain Storage Unit indicate that the project is not a sound one in economic terms. This is attributable to the short growing season which will limit the capacity utilization of the facility on an annual basis to approximately 25 percent. As a result the unit will not recover its investment costs. The analysis does indicate, however, that with increasing throughput of local grain, by the third full year of operation revenues generated will exceed operating expenses on an annual basis.

4.5 Beef Production Incentive

The general objective of the Beef Production Incentive is to provide financial assistance to producers to encourage expansion of the beef breeding stock. It was anticipated that the programme would assist in expanding the beef breeding stock by 20,000 head over a five-year period. The total estimated cost of the Beef Production Incentive was $2 million. By the end of the fourth year of the Programme, 34 percent of its objective in terms of expansion of the breeding stock had been achieved. It is difficult to assess the impact that this Programme has had on the size of the breeding stock in Nova Scotia. One of the more difficult problems is isolating its effects from similar programmes which operated prior to its inception and concurrently with it.

In general, the Cost-Benefit methodology conforms to the approach described in Chapter Two. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the operations of all participating beef producers as though they were a single cow-calf enterprise. A Benefit-Cost Ratio of .90 was derived from the analysis. From a socio economic perspective the Programme is not a sound one. The results in this particular case, however, depend very much on the accuracy of one critical assumption, namely, the price of beef. The beef prices used in the base case analysis were set at a level which was estimated to be the minimum necessary to provide the incentive for continued production.

4.6 Hog Production Incentive

The purpose of the Hog Production Incentive is to assist in the expansion of the hog industry by providing incentive grants for new or expanded hog production units. Over the five-year life of the project, it was expected that the equivalent of one hundred 60 sow farrow-to-finish units would be added to the existing base. The estimated cost of the Programme was $8 million. After the first four years, 99.75 of the 60 sow equivalent units had been constructed.

The methodology used in the Cost-Benefit Analysis of the Hog Production Incentive Programme follows the approach set out in Chapter Two. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the operation of a 65 sow farrow-to-finish production unit over the twenty-year evaluation period. The results of the Benefit-Cost Analysis of the Programme indicate a Benefit-Cost Ratio of 1.01. Therefore, from the perspective of society as a whole, the programme to date has been worthwhile.

4.7 Sheep Production Incentive

The Sheep Production Incentive was designed to increase the breeding stock of ewes by 12,000 head over the five-years of the Agreement. The total estimated cost of the Programme was $300,000. Over the first four years, 6,742 ewes were added to the provincial breeding flock, representing 56.1 percent of the intended target.

In general, the method used for the analysis of the Sheep Production Incentive conforms to the approach set out in Chapter Two. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the operation of a flock containing 124 breeding ewes at the inception of the incentive and over a 20-year period. The analysis generated a Benefit-Cost Ratio of 1.02 which indicates that the Programme has been beneficial to society as a whole.

4.8 Purebred Sheep Breeding Stock Incentive

The overall objective of the Programme was to add 500 high quality animals to provincial flocks over five years. Estimated five-year costs were $100,000. Project performance has been uneven at best. At the end of the first four years, 86 animals had been imported with assistance being paid on 60 of these.

Participation in this Programme has been too small and sporadic to afford any real information for Cost-Benefit Analysis.

4.9 Manure Storage Incentive Programme

The Manure Storage Incentive Programme is linked directly to programmes designed to lead to an expansion of livestock numbers in the Province and, as well, is directed at replacement of existing facilities deemed inadequate for environmental or purely economic reasons. It was estimated that the Programme would be taken up by at least 400 farms. The estimated five-year cost of the Programme was $3.2 million. After the first four years a total of 621 facilities had been constructed. Even with a considerable number of repeat participants, the Programme would appear to have achieved its target.

In general, the Cost-Benefit methodology adheres to the format set out in Chapter Two. A minor departure occurs, however, in the approach taken to determine project benefits. Value in this case is not based on a market price for manure, but on its nutrient content. A Benefit-Cost Ratio of 1.2 was generated by the analysis which leads to the conclusion that the Programme has been worthwhile in economic terms.

4.10 Tree Fruit Incentive

The major aim of the incentive was to expedite the replacement of older trees bearing less than desirable varieties. In essence, it is a revitalization programme of the production sector. The overall objective was to plant 250,000 trees over five years. The estimated cost of the Programme was $500,000. By 1979, $415,532 of the allocation had been taken up for total plantings of 206,751 trees. A stable core of about 95 eligible growers seems responsible for taking up the Programme.

The format of the Cost-Benefit Analysis outlined in Chapter Two was modified in two major respects for the Tree Fruit Incentive:

a) a project period of 30 years was chosen to allow for the maturing and production of apple trees planted during the incentive;

b) the projections are done twice; once with the incentive, once without the incentive.

The Benefit-Cost Ratios generated by the analyses are .91 considering the incentive, and .99 without the incentive. From a socio economic perspective, the project has not been worthwhile. High costs in the initial years, due to losses from prematurely cleared trees and costs of land clearing and preparation, are not offset by the value of production over the 30-year evaluation period.

4.11 Bulk Bin Construction Programme

The purpose of the Bulk Bin Construction Programme is to assist commercial tree fruit and vegetable producers to construct bulk bins for the transport or storage of fresh fruit and vegetables and, thereby improve handling and storage efficiency and product quality. The specific objective of this Programme is to construct 75,000 bulk bins over the five-year duration of the Agreement. The estimated five-year cost of the Programme was $1.875 million. Over the first four years of the Agreement 58,875 bulk bins have been constructed.

The methodology used in the Cost-Benefit Analysis adheres to the approach outlined in Chapter Two. The incremental capital and operating costs and revenues were estimated using historical data and by simulating the cost advantages of using bulk bins over bushel boxes for handling the output of one acre of apple orchard. A twenty-year evaluation period was employed. A Benefit-Cost Ratio of 2.47 was generated by the Benefit-Cost Analysis. From the point of view of society as a whole, the project has been worthwhile.

4.12 Refrigerated Containers

The purpose of the Refrigerated Containers Incentive is to assist in developing international markets for Nova Scotia fruits and vegetables through the expanded availability of refrigerated containers. Originally it was the intention of the Programme to bring 20 containers into service, however, this number proved to be insufficient and another 20 "reefers" were purchased in 1978. The total expenditure for the forty containers was $900,711 in constant dollars. The ownership of these containers has served as a market guarantee for Nova Scotia producers.

In general, the Cost-Benefit methodology follows the format set out in Chapter Two. There is a slight difference in treatment in that the costs and benefits of associated blueberry acreage are included in the analysis. The incremental capital and operating costs and revenues were estimated using historical data and by simulating the cost and revenue impact of the operation of the containers and the resultant expansion of blueberry acreage. A twenty-year evaluation period was employed. A Benefit-Cost Ratio of 1.32 was generated by the analysis. From a socio economic perspective, the incentive has been worthwhile and should contribute to the strength of the fruit and vegetable sector.

4.13 Greenhouse Incentive

As part of the overall objective of developing greater self-sufficiency in the production of agricultural commodities in Nova Scotia, the greenhouse industry was provided incentive to increase greenhouse capacity by 350,000 square feet over the five year Agreement. Total greenhouse project expenditures were estimated to be $3.2 million over five years. Over the four year time span covered in this report, actual government expenditure amounts to $388,675 or 49 percent of planned government expenditure of $800,000.

The method of analysis is similar to that outlined in Chapter Two. However, data related deficiencies lead to some uncertainty concerning the definition of the average or representative greenhouse portrayed in the analysis. A Benefit-Cost Ratio of 1.02 was generated by the Cost-Benefit Analysis. This indicates that the Programme is worthwhile from the perspective of society as a whole.

4.14 Marketing Facilities

The purpose of this project is to upgrade seasonal livestock auction sales' facilities with particular emphasis on the buildings in Truro. A secondary project objective appears to have been to construct a beef bull testing station at Nappan. A five-year total expenditure of $100,000 was planned for this project. Over the first four years of the project, $81,091 was expended.

Lack of quantitative information on the impact of this project prevents any evaluation of it on economic efficiency grounds. However, it does appear that the project carried out tasks which are directly related to its initially stated objectives, and the improvements made will serve to strengthen livestock production and marketing in Nova Scotia.

4.15 Technology Adoption

The major concern which prompted the creation of this project was the wide variability of productivity on Nova Scotia dairy farms, ranging from 8,000 pounds to 16,000 pounds per cow average. Thus, the main purpose of this project is to increase efficiency of animal units through the provision of dairy herd testing, performance services and management systems. Total planned expenditure over the five-year period was $100,000. Actual expenditure over the first four years amounted to $126,941.

The nature of the project was such that it was not possible to conduct a Cost-Benefit Analysis. Whether the benefits created through the programme justify the costs incurred, we are unable to say at this time.

4.16 Innovative Demonstration

The main thrust of this programme is to provide assistance with on-farm demonstrations and localized demonstration projects. Many of the projects comprising the programme can be considered as exercises in applied research. The estimated five-year cost of the programme was $1 million. Total expenditure after the first four years amounted to $621,910.

It was not possible to apply conventional Cost-Benefit methodology to this programme because of the wide array of projects involved. Projects ranging from land clearing techniques to new technology in fruit production have been implemented. Not only are benefits and costs difficult to assess from this array, but so too are the timing of these costs and benefits. Therefore, we are unable to say whether or not the benefits created can justify the costs incurred.

5. Sensitivity Analysis

All projects were tested in order to determine the sensitivity of the results to changes in base-case variables and to changes in the discount rate. As a general comment, the sensitivity analysis indicated that most projects were very sensitive to changes in market prices on both the input and output side (e.g. feed grains and livestock prices) and to changes in the discount rate.

6. Incrementality

Considerable investment had taken place in the agriculture sector in the years prior to the implementation of Subsidiary Agreement programmes. It is arguable that some of the resources used in these programmes would have been used for the same purposes over the same time period in the absence of incentives offered under the Agreement. Since society would have enjoyed the resulting benefits (costs) even without the incentives, not all benefits (costs) which were generated can be attributed solely to these programmes. An adjustment has been made to allow for the proportion of project activity that would have occurred anyway and this has been netted out of our estimates of the total net present value associated with each of the projects. Thus, the actual net present value which has been reported in each case represents that which can be considered truly incremental, that is, work which would not have been undertaken without incentives.

The matter of estimating incrementality presents formidable statistical problems not the least of which are the data requirements. In this Report estimates of incrementality were based on information contained in a Survey of participants carried out by the Nova Scotia Department of Agriculture and Marketing early in 1979. The Survey was supervised by the Evaluation Committee for ADA-II which included representatives from the provincial Departments of Agriculture and Marketing and Development, and federal Departments of Agriculture and Regional Economic Expansion. While we have relied on this information for our estimates we would caution the reader that the results should be treated with some circumspection given the subjectivity of the responses to the survey questions. In light of the economic environment facing farmers during the late 1970's, the incentives offered under the Subsidiary Agreement were more important in generating agricultural activity than the Survey results indicate.

7. Economic Impact

Economic impacts in terms of incremental jobs created and incremental income generated were calculated separately for the construction and operations phases. Construction related impacts were calculated on an annual basis for each of the four years under consideration. These impacts are not recurrent. Operations-related impacts were based on the level of production which would occur on all (incremental) participating farms when they reach full production (to simplify the analysis this was assumed to be year five of the twenty-year evaluation period). This, then, is a recurrent value but is reported for a representative year only.

Table ES-2

Aggregate Incremental Impact
Employment and Income

	1976	1977	1978	1979
Construction Phase				
Direct jobs	109	165	221	176
Indirect and Induced jobs	100	148	198	157
TOTAL	209	313	419	333
Direct Income ($'000)	1,478	2,405	3,459	2,991
Indirect and Induced Income ($'000)	1,456	2,280	3,247	2,827
TOTAL	2,934	4,685	6,706	5,818

	Employment	Income: Annual ($'000)	Income: NPV[2] ($'000)
Operations Phase[1]			
Direct	331	4,625	36,184
Indirect and Induced	241	3,282	25,677
TOTAL	572	7,907	61,861

Note: 1. employment and income figures are reported for one year only.
2. indicates the net present value of annual income generated over sixteen year project life.

The impacts are presented in summary form in Table ES-2. Impacts are divided into the following three categories:

a) Direct Impact: This consists of the employment and associated income generated by the construction and operation of projects financed under the Agriculture Subsidiary Agreement. The construction jobs and income will be realized in the construction industry. Jobs and income associated with the operation stage of projects will occur on farms in Nova Scotia.

b) Indirect Impact: This consists of the employment and income generated by the purchase of goods and services used as inputs during the construction and operation phases of projects financed under the Agreement.

c) Induced Impact: This consists of the additional income and employment induced by the respending of incomes generated in the direct and indirect impacts. This is what is often referred to as the "multiplier effect."

Estimating the direct employment and income impact can be done either through a survey of the participants in the Agreement or by an approximation method using average ratios for the labour content and associated income in construction and operation phases. The latter procedure was used in this study, since conducting a special survey was well beyond the scope of available resources.

Indirect impact is concerned with the purchase of goods and services used in the construction or operation of the project. Deriving such estimates on a commodity-by-commodity basis requires detailed information about producers and suppliers at a level which is generally unavailable, at least at reasonable cost. Accordingly, the indirect income and employment impacts were derived by multiplying expenditure values by the appropriate income and employment multipliers from the 1974 Nova Scotia Input-Output System.

Similarly, the induced effects of project expenditures are calculated by multiplying the first round sectoral employment and income by the appropriate sector multiplier from the Nova Scotia Input-Output System. As noted previously, the economic impacts reported in Table ES-2 are limited to those which are directly attributable to incentives offered under the Subsidiary Agreement.

It is important to note as well that the impacts reported in Table ES-2 are based on an assumed or given economic structure, namely the one portrayed by the Input-Output System. Estimating impacts using this approach neglects what are called forward linkages, that is, the income and employment that may be generated by the use of increased agricultural output as inputs into the food processing sector. Accordingly, the figures set out in Table ES-2 do not include employment and income which incremental activity in primary agriculture have generated in the processing sector.

As a rule, forward linkages are more dynamic, less stable and less predictable in their timing and intensity than backward linkages. This feature makes estimating the associated income and employment much more difficult. For Subsidiary Agreement activities, the major area of forward linkage appears to be in hog production. The rapid increase in hog production at the farm level has led to an increase in Nova Scotia processing. On an incremental basis, we estimate that 10 to 15 additional jobs in processing can be attributed to the success of the hog production incentive programme. Moreover, with a generally improved agricultural base in Nova Scotia it is quite possible that additional expansion will occur in other parts of the processing sector in the future. Some of the associated income and employment would be attributable to the success of Agricultural Subsidiary Agreement I.

8. Overall Assessment

In overall terms, the programmes initiated under the Subsidiary Agreement made a positive contribution to the achievement of GDA objectives. No attempt was made to quantify the degree to which these objectives were reached since the objectives are not expressed in quantifiable terms. Our conclusion was based on the results of the project analyses which indicated the economic soundness of most projects. In this sense the projects could be expected to contribute to the viability of the agricultural sector in Nova Scotia and strengthen the fabric of rural life in the Province.

CHAPTER ONE

1. Background

1.0 The Agricultural Subsidiary Agreement

The Canada-Nova Scotia Subsidiary Agreement for Agricultural Development (the "Sub") was signed in June of 1976 for a period of five years (to the end of March, 1981). A total amount of almost $30 million was allocated by the Federal government through the Department of Regional Economic Expansion to be supplemented by a further $8 million from the Province of Nova Scotia for cost-sharable programmes on an 80:20 (Federal:Provincial) basis. The Subsidiary was implemented by the Nova Scotia Department of Agriculture and Marketing. In programmes involving capital works on the farm, this sum was to be supplemented further by private financing for total estimated expenditures of almost $57 million. The purpose of the Sub was to enable Canada and the Province to jointly undertake programmes to develop the agriculture industry in Nova Scotia.

1.1 The Study

The general objective of this study is to provide an interim evaluation of the programmes/projects undertaken. Unless otherwise noted, the study will examine activities initiated between 1976 - 1979 inclusive.

In order to achieve this general objective three conceptually distinct analyses have been prepared, with emphasis placed on the first of these:

a) a social Cost-Benefit Analysis of each of the programmes/projects. This analysis is confined to the direct social costs and benefits attributable to each of the projects and will provide an indication of the economic efficiency of each project. In other words, by calculating the present value of the stream of project net benefits we are able to determine whether, on the strength of the economic efficiency criterion, the project is worthwhile.

b) an estimate of the income and employment effects arising from each of the projects. This estimate is based on the direct and induced effects attributable to the capital and operating expenditures arising from each project. This operation will not utilize new information but will simply re-interpret data used in the Cost-Benefit Analysis and present this in a different format. As explained in greater detail in the methodological section which follows, this type of analysis addresses certain distributional issues but does not provide a criterion for accepting or rejecting a project in and of itself.

c) an overall assessment of the programme. It is possible that projects will be acceptable on economic efficiency grounds and not contribute significantly to the broader distributive and other objectives specified in the General Development Agreement. The overall assessment of the programme examines the degree to which the projects have contributed to the achievement of the following objectives:

i) encourage the expansion or maintenance of viable, long-term employment opportunities and optimum quality of life within Nova Scotia;

ii) increase the earned incomes of the people of Nova Scotia; and,

iii) assist in the development of a dynamic and creative provincial economy which will encourage the growth and stability of economic activity in Nova Scotia.

In addition, the overall assessment will provide a descriptive treatment of non-quantifiable factors such as environmental quality.

The methodological framework within which the cost-benefit analysis and economic impact assessment have been undertaken is set out in Chapter Two.

1.2 Historical Overview of Agriculture in Nova Scotia

1.2.1 Trends From European Settlement to 1950

The economies of the Maritime Provinces have evolved on a narrow resource base comprised of fish, timber, minerals, and, to a lesser extent, agriculture. Since the first European settlement in the mid-eighteenth century there has been a series of relatively short-lived periods of prosperity, each followed by a more prolonged period of economic depression. Development of agriculture, although consistently and optimistically regarded as fundamental to overall economic development, has more typically been associated with the periods of depression rather than periods of expansion. During periods of decline a progressively larger pool of labour found itself unemployed and agriculture was usually proposed as the solution to this problem of surplus manpower. New waves of land clearing were thus prompted which usually resulted in partial or total abandonment after a few years.

Initially the industry developed to supply local markets and even these were difficult to service because population was scattered and roads were poor. Early development was further hampered by lack of capital, poor farming practices and, above all, a land resource rarely suitable for cropping.

After World War I, adoption of the internal combustion engine to agriculture coincided largely with the westward movement of the agricultural centre of gravity which had begun with the completion of the trans-continental railways in the 1890's. There was also more and more involvement, directly and indirectly, by government beginning particularly in the 1930's and for many years national policies and programmes were tailored largely towards western farmers. Only in the west, it was thought, could farm operators attain the size necessary to justify investment in expensive technology.

Farm operators in Nova Scotia remained small and highly fragmented. The land tends to roll steeply and the growing season is short, and such characteristics do not accommodate technological innovation easily. Topographically and climatically favoured areas such as the Annapolis Valley have generally competed successfully by specialization into a narrower range of products. The pattern of dairy-based mixed farming typical of larger areas is diversified enough to absorb some of the effects of violent swings between good and bad years but it does not equip farmers to take full advantage of higher prices. Low farm incomes have become endemic and, over the years, have forced many farmers to seek other sources of income. Between 1931 and 1976 the proportion of Nova Scotians living on farms declined from almost 35 percent to 1.5 percent and, over the same period, the number of census farms in Nova Scotia went down from 40,000 to less than 3,500. Much of the land which thus came on to the market was not absorbed by other agricultural operators and was abandoned.

1.2.2 Characteristics of Nova Scotia Agriculture Since 1950

To a significant degree the legacy of a fragmented agricultural structure persists in Nova Scotia. In the 1976 census of Agriculture, 1,527 out of a total of 3,441 census farms (those with more than $1,200 in sales) had sales of less than $5,000 and only 244 sold more than $100,000 worth of agricultural products. These 244 farms account for a disproportionate amount of total agricultural activity. Persistent problems have included:

- low incomes
- small size of farms
- cleared land growing back into trees and shrubs
- lack of adoption of new technology
- increasing abandonment of farms
- fewer young people farming
- prevalence of part-time farming.

Census figures illustrate some of these problems (see Table I-1) and although these are gross data a pattern emerges of a competitive disadvantage vis-à-vis

Table I-1

Selected Agricultural Indicators, Canada and Nova Scotia 1961 and 1976

	Canada		Nova Scotia	
	1961	1976	1961	1976
Farms selling less than $2,500 annually (% of total commercial farms)	26.7	10.4	38.9	26.4
Sales More than $10,000 annually (% of total commercial farms)	14.1	61.5	12.8	41.2
Average area per farm (acres)	359	553	178	287
Average area of improved land per farm (acres)	215	360	40	106
Value of machinery and equipment per farm ($)	5,341	39,393	2,417	19,112
Farmers less than 35 years old (% of total)	16.7	19.1	8.6	14.2
Farmers more than 60 years old (% of total)	20.5	18.7	31.9	24.6
Proportion of farm operators reporting off-farm work (%)	32.0	31.1	52.7	38.6

Source: Statistics Canada, Censuses of Agriculture, 1961 and 1976

Canada as a whole. Other, less quantifiable, structural defects such as a chaotic pattern of land tenure, an aversion to credit and considerable pressures on better farming areas by urban and recreational land uses also remain widespread.

Major physical limitations hinge on climate. Few areas of the Province have more than 2,500 corn heat units annually, a level which sustains crop production over large areas of southern Ontario. In the face of limitation to cropping, however, there are about 2.8 million acres of higher capability land (classes 2, 3 and 4 of the Canada Land Inventory Classification) which fall into contiguous blocks sufficiently large to promote significant expansion. Only about 627,000 acres are presently cleared and not all this total is being actively farmed.

Much of the Province's agricultural activity (and much of its true potential) occurs in three areas:

a) the Annapolis Valley (Kings and Annapolis counties);
b) central Nova Scotia (Hants and central Colchester counties);
c) the Northumberland Lowland (extending from northern Cumberland County through northern Colchester to Pictou and Antigonish counties).

In 1976 these counties accounted for 75 percent of all census farms in Nova Scotia, 77 percent of all land in farms, 84 percent of all improved land and 85 percent of the area under crops. Basic indicators to summarize changes in the agricultural sector since 1951 are presented in Table I-2

1.3 Essentials of the Agreement

1.3.1 Production Deficiencies

For structural, climatic and cultural/historical reasons agricultural production in Nova Scotia has consistently fallen short of demand in virtually all commodity groups. Table I-3 summarizes the commodity shortfalls for 1973.

Table I-2

Basic Indicators of Nova Scotia Agriculture
1951 and 1976

	1951	1976	% change 1951-79
Population on Census Farms	115,414	12,479	-89
Population on Farms as % of Provincial Population	18.0	1.5	-
Number of Farms	23,515	3,441	-85
Area of Land in Farms (acres)	3,173,691	989,037	-69
Improved area in farms (acres)	661,975	365,353	-45
Cropped area in farms (acres)	477,459	247,273	-48
Net Farm Income ($\$10^3$) [1]	24,747	50,796	105
Operation and Depreciation [1] Charges ($\$10^3$)	24,869	104,804	321

Sources: Censuses of Agriculture 1951, 1976. Nova Scotia Department of Agriculture and Marketing, Agricultural Statistics, 1978.

Note: 1. These are 1978 figures.

Largely because of these preceived shortfalls in major commodity groups the Subsidiary Agreement indicated that development opportunities existed in three general categories:

a) meat production (for import substitution);
b) high energy and protein crops (for import substitution);
c) horticultural crops (to maintain competitiveness in export markets).

The conclusion that these opportunities existed rested not simply on the recognition of a deficit in commodity groups but on the perception that agricultural production capacity was under-exploited. For economic and social reasons, it was necessary to attempt to overcome the constraints which prevented a more rational and efficient use of the agricultural resource base.

The Sub sets out three general objectives:

a) improve the viability and stability of the agriculture industry and enhance its ability to sustain growth;
b) maintain existing and create new employment opportunities in the agriculture industry; and,
c) expand the output and productivity of under-exploited components of the agriculture industry which enjoy an economic advantage in provincial or export markets.

The strategy designed to achieve these objectives contained four elements:

a) expansion of the agricultural land base;
b) development of farms of suitable type and size to achieve production targets and import substitution goals;
c) retaining and attracting full-time farmers with the capability and capacity to increase production at the rate projected;
d) training and technology utilization.

1.3.2 Programmes:

To achieve these objectives the following programmes/projects were designed and have been implemented:

1. Land Clearing and Land Improvement
2. High Energy and Protein Crop Incentive
3. Feed Facility Incentive
4. Central Grain Storage Unit
5. Beef Production Incentive
6. Hog Production Incentive
7. Sheep Production Incentive
8. Purebred Sheep Breeding Stock Incentive
9. Manure Storage Incentive Programme
10. Tree-Fruit Incentive
11. Bulk Bin Construction Programme
12. Refrigerated Containers
13. Greenhouse Incentive
14. Marketing Facilities
15. Technology Adoption
16. Innovative Demonstration

Table I-3

Balance Sheet for Selected Commodities
Nova Scotia, 1973

	Production	Consumption	Surplus (Deficit)	Production Consumption %
Meat				
Pork ('000 lbs)	16,062	43,543	(27,481)	36.9
Beef ('000 lbs)	16,258	60,770	(44,512)	26.7
Veal ('000 lbs)	1,051	2,150	(1,089)	48.9
Mutton/lamb ('000 lbs)	664	1,964	(1,300)	33.8
Chicken/fowl ('000 lbs)	24,406	26,912	(2,426)	90.7
Turkey ('000 lbs)	2,000	4,940	(2,940)	40.5
High Protein Crops				
Grain ('000 tons)	44	221	(177)	19.9
Horticultural Crops				
Apples ('000 bu.)	1,950	941	1,009	207.2
Blueberries ('000 bu.)	10,200	950	9,250	1,073.7
Strawberries ('000 qts)	1,500	2,500	(1,000)	60.0

Source: Department of Regional Economic Expansion, Subsidiary Agreement, Agricultural Development Canada/Nova Scotia, 1976, pp. 18-19.

CHAPTER TWO

2.0 Evaluation Methodology

2.1 Definition of a Project

The commitment of resources to expanded agricultural production in Nova Scotia called for in the Subsidiary Agreement is organized on a program and project basis. This evaluation exercise examines each project in the Agreement in economic efficiency terms, that is, whether the resources committed to the project are used in a way that is at least as productive as the best alternative use. To accomplish this end, each project is treated as an activity which mobilizes resources to produce a benefit. The outputs produced by a project are regarded as its benefits while the resource inputs are treated as costs.

Costs fall into two categories:

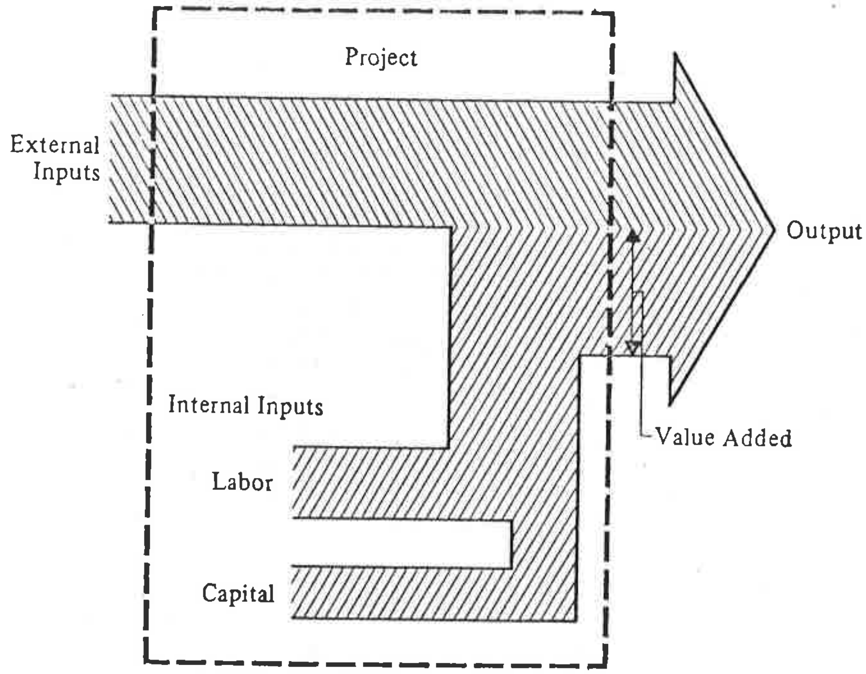
a) Investment costs are those expenditures involving either direct cash outflow or an implicit opportunity cost which occur during what is frequently referred to as the construction phase of a project. Normally most of these costs must be incurred before a project can produce any output and often they involve construction of physical structures. Under the Agriculture Agreement, however, land clearing and land improvement activities such as under-drainage, or the acquisition of heifers or ewes, all fall into the investment expenditure category.

b) Operating costs are those expenditures incurred on an on-going basis in order to produce the project's outputs. Such costs may require a direct out-of-pocket cash expenditure or may be an (implicit) opportunity cost. Wages paid to hired labour would be an example of the former; the value of output foregone from a piece of land when its use is switched from production of one crop to another is an example of the latter.

This view of a project may be summarized diagrammatically. On the one hand, focusing on the real resource flows associated with a project leads to the conceptualization shown in Figure II-1. In the case of say a grain growing project, external inputs (or intermediate goods) would include seeds, ferti-

Figure II-1

General Model of a Project Primarily From the Standpoint of Economic Analysis Showing Real Resource Flows



Source: J. Price Gittinger, Economic Analysis of Agricultural Projects, p. 95.

lizer, pesticides and so on. Internal inputs would include the labour and capital supplied on the farm. Total output is made up of the contributions of all inputs to the flow of output, while the value added of the project is that part of the total output which can be attributed to capital and labour.

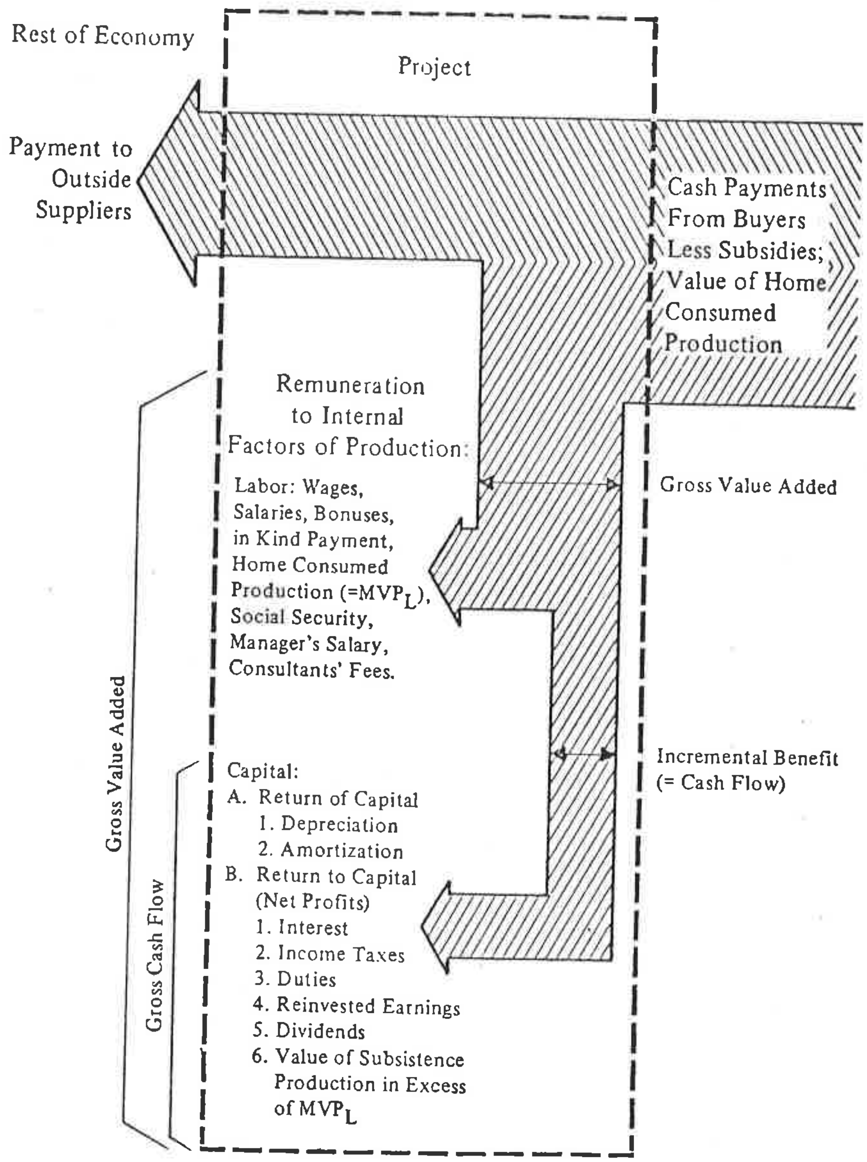
On the other hand, focusing of the money flows associated with a project leads to a diagram like Figure II-2, which is a mirror image of Figure II-1. Here inflows to the project arise from sale of project output for cash or from home consumption of project output. Outflows from the project are shown flowing to outside suppliers. The difference between the two flows is the gross value added of the project, which is identical to payments made to the (internal) factors of production, labour and capital. Value added is split between the primary factors of production, labour and capital. What remains after labour has been remunerated is called the cash flow. Maximizing the cash flow, which in these terms amounts to maximizing the gross return to capital, corresponds to maximizing value added, assuming that labour has been paid according to its marginal value product, and consequently corresponds to maximizing capital's contribution to national income. This view of project objectives is really another way of saying that the project evaluation undertaken in this study will assess the merits of each project on economic efficiency grounds.

2.2 The Approach to Cost-Benefit Analysis

In the previous section, a project was defined as an activity which uses resources to produce a desired output. A project will incur costs annually in order to produce its benefits. Generally, project benefits fall into three categories. First, project output sold off the farm generates a revenue; second, project output used directly on the farm may improve productivity or reduce costs. The former increases revenue incrementally relative to what it would have been without the improvement; the latter yields savings equal to the difference be-

Figure II-2

General Model of a Project Primarily from the Standpoint of Economic Analysis Showing Money Flows



Source: J. Price Gittinger, Ibid, p. 96.

tween on-farm cost of the project output and the market price of purchasing the good or service. Third, for the individual farmer, participating in the project allows him to gain an incentive or subsidy payment. In the initial calculation of project benefits all three categories are included.

The justification for committing resources to a project is that the flow of benefits that it yields over its life will equal or exceed the flow of costs incurred. To make the benefits and costs incurred at different points in time commensurate, all future benefits and costs are discounted to a common base year, 1978. Further, all benefits and costs accruing under the Agreement associated with 1976 or 1977 were transformed into 1978 values using the Gross National Product (GNP) deflator. Except for the tree fruit incentive where a 30 year project lifespan was assumed, all projects are analyzed over a 20 year period. Prices prevailing in 1978 were used to value all costs and benefits thoughout a project's life unless there was good reason to believe that a particular commodity price was likely to increase or decrease relative to all other prices. Such instances are noted in the discussion of the individual projects.

Deciding whether a project is an efficient user of resources calls for a comparison of the benefits generated with the costs incurred. The primary criterion used in this work is Net Present Value (NPV). For each year in the project's life, net benefits are calculated as benefits less cost. The values are all discounted back to the beginning of year 1. The sum of the discounted values is called NPV. A negative value indicates that (discounted) benefits are less than (discounted) costs and the project is not a good one. A zero value shows that benefits are just equal to costs over the project's life, while a positive value reveals benefits exceed costs. The last two results indicate marginally acceptable and acceptable projects.

An alternative criterion for judging the acceptability of a project is the benefit cost ratio (BCR). Its value is calculated as the ratio of the present value of benefits to the present value of costs. A BCR of 1 indicates a marginal project. Acceptable projects will exhibit a BCR greater than 1; unacceptable projects show a BCR less than 1. Although the NPV criterion is generally preferred in the literature, both NPV and BCR results are reported in this study. Since none of the projects appear to have been subject to a binding capital constraint, no difficulties arise from this procedure.

Choice of the discount rate used to calculate the present value of net benefits is important. In the approach taken here, the discount rate is meant to reflect the rate of return that capital could earn in alternative (to the project) uses. Thus, whenever a project exhibits a non-negative NPV, the return made to invested capital is at least as good as the best alternative use.

Selection of the actual value for the discount rate is hampered by uncertainty concerning the true value of the rate of return to capital in the private sector in Canada and also the true value of the social opportunity cost of capital in Canada. A base (real) value of 10 percent was used for most of the calculations of NPV undertaken in this study. However, to reflect the uncertainty concerning the true value and also to check the sensitivity of the projects themselves to different discount rates, values of 5 and 15 percent were tested.

2.3 Financial vs. Economic Analysis

There still remains a question of whose perspective should be used in judging the acceptability of a project investment: the private sector individual or firm undertaking the construction and operation of the project, or society at large which is partly financing the project and which may reap benefits or incur costs in excess of those accruing to the private operator. To capture the significant differences between the two perspectives, each project is subjected to both a Financial Analysis and an Economic Analysis.

The Financial Analysis is undertaken from the point of view of the private individual or firm actually undertaking the project. Project outputs or benefits and project investment and operating costs are valued according to market prices, inclusive of subsidies and indirect taxes. As calculated in this study, the NPV indicates what the operator (as the owner of the invested capital) can expect to retain over the 20 year life of the project, gross of any income tax liability that may result.

It may be noted that no mention is made of depreciation throughout this report. The reason is simple. Depreciation is automatically accounted for in the cash flow method used to calculate benefits, costs and ultimately NPV. A NPV of zero at the chosen discount rate means that the project has returned over its life exactly the amount of capital invested. Evidently a postive NPV indicates that all invested capital has been recovered plus some additional return to the owner of the capital. Once this is recognized there is no further need to deal explicitly with depreciation.

For the Economic Analysis, certain adjustments must be made to the prices used to value benefits and costs to make them reflect social opportunity cost. In this study these adjustments fall into two categories: elimination of indirect taxes and subsidies included in project benefits and costs under the Financial Analysis and the use of a shadow wage rate for labour which more accurately captures the social opportunity cost of labour in Nova Scotia. Under some circumstances it could be argued that a shadow foreign exchange rate should be used as well to capture the social value of foreign exchange used or generated by the project. Our analysis of the projects indicates that foreign exchange plays a negligible role in all projects except possibly Refrigerated Containers. On this basis it was decided not to pursue a shadow price for foreign exchange.

For the private operator of a project, indirect taxes do represent a cost while subsidies are a form of revenue. From society's point of view, however, indirect taxes and subsidies are merely transfers of purchasing power among individuals and firms, and do not require the use of resources or generate new resources. Hence, in the Economic Analysis, any indirect taxes or subsidies affecting the project are netted out of the estimated project benefits and costs.

Labour used in the construction or operation of a project is treated as a hired factor of production. In project costing, an actual or imputed wage is charged for labour time. The wage rates used are based on the prevailing market wage rates. From society's point of view, the social opportunity cost of employing one additional unit of labour on a project in the Agreement is the value of goods and services that would have been produced in alternative employment. However it is well known that market wage rates will reflect true social opportunity cost of labour if and only if labour markets are strongly competitive and functioning smoothly and efficiently. The relatively high levels of unemployment of labour that have existed in Nova Scotia for a long period of time suggest these labour market conditions do not hold. Institutional rigidities, relative immobility of labour, both between occupations and geographically, lack of appropriate skills, weak demand for labour by industry, and a relatively good unemployment insurance scheme all contribute to relatively inflexible wage rates which do not adjust to clear the labour market. The upshot is that a shadow wage rate must be established to capture the true social opportunity cost of labour.

A vast literature has accumulated in economics dealing with the problem of estimating the shadow wage rate. A wide range of solutions are offered. Haveman and Krutilla (1968) place a zero value on social opportunity cost if an additional worker is hired from the ranks of the unemployed because an unemployed worker was producing nothing. Based on an assumption of inter-occupational immobility of labour, they argue that the shadow wage rate will increase toward the market rate as the general unemployment rate and unemployment rates prevailing in specific occupational categories decline. Harberger (1971) suggests that the labour force be split into the protected (unionized) and unprotected (non-unionized) sectors. Wages in the unprotected sector will then provide a reasonable proxy for the minimum supply price of labour since there will be a tendency for workers to shift from the unprotected to the protected sector when the demand for labour increases in the latter sector. Jenkins and Kuo (1978) use a similar labour market split in a much more sophisticated analysis which includes provision for minimum supply price for labour, estimation of the value of leisure time to unemployed workers and a labour market model involving specific assumptions concerning the migration behaviour that occurs in response to the demand for labour exhibited by a new project. A major problem with the Jenkins and Kuo approach is its high data requirements which may be either unfeasible or too expensive to employ in the analysis of some projects.

A more detailed summary of the literature on shadow wage rates is given by Sharma (1979). This study adopts the suggestion he makes for estimating the shadow wage rate. From the Jenkins and Kuo work on Cape Breton, Sharma notes that the labour externality (that is, the present value of the difference between the market wage and the shadow wage) is 80 percent of the market wage. Hence the shadow wage rate will be 20 percent of the market rate. This figure is based on the assumption that all of the workers on a new project will be drawn from the unemployed. Sharma argues that it is more likely that about 50 percent of the project related employment will be taken up by the unemployed. In this case the labour externality drops to 40 percent and the shadow wage rate jumps to 60 percent of the market rate. In other words, the social opportunity cost of labour is 60 percent of the market wage rate.

The next question is whether such a shadow wage rate would apply over the 20 year project life used in this study. In general, as Haveman and Krutilla argue, the gap between the market wage rate and the shadow wage rate will shrink or widen as the unemployment rate declines or increases respectively. Or, to put it differently, the tighter the labour market, the closer the shadow wage will move to the market wage, other things equal. Another factor which would tend to raise the shadow wage rate would be an increase in the skill levels required of the labour employed on funded projects. Clearly, then, the behaviour of the shadow wage rate depends on developments in Nova Scotia labour markets.

A brief review of the labour market situation facing Canada and in particular Nova Scotia over the next 20 years suggests several reasons why there will be upward pressure on the value of the shadow wage rate. First, shifting demographic patterns in Canada indicate that tighter labour markets will begin to emerge around 1985 and continue for some time thereafter. The youth bulge of new labour force entrants will have passed leaving women as the major source of expanded labour supply. Because these shifts in the labour market will be caused more by demographic changes than by a rapid expansion in economic activity, there may not be a significant reduction in the overall unemployment rate. Moreover, some analysts argue that there will be definite shortages in the supply of skilled labour. This will open up new opportunities for people to seek training and take up these positions. Second, the trend in agriculture toward the employment of more highly trained and skilled persons will continue. Third, in Nova Scotia, construction and operation of the third Michelin plant, new coal developments in Cape Breton, continued strength in the fishing industry and the probable developments related to off-shore gas and oil will add significantly to the demand for labour, a situation which reinforces the contention that much tighter labour markets will be a factor in the province in the post-1985 period.

In conclusion, then, to reflect the coming evolution of the labour markets, the shadow wage rate used in this study increased from a value of 60 percent of the market rate to 90 percent of the market rate according to the pattern shown in Table II-1.

Table II-1

Shadow Wage Rate as a Proportion of the Market Wage Rate - 20 Year Period

Year		Year	
1 (1978)	.6	11 (1988)	.8
2 (1979)	.6	12 (1989)	.85
3 (1980)	.6	13 (1990)	.9
4 (1981)	.6	14 (1991)	.9
5 (1982)	.6	15 (1992)	.9
6 (1983)	.6	16 (1993)	.9
7 (1984)	.6	17 (1994)	.9
8 (1985)	.65	18 (1995)	.9
9 (1986)	.7	19 (1996)	.9
10 (1987)	.75	20 (1997)	.9

To sum up, in the Economic Analysis the objective is to assess a project from a broad public point of view. Benefits and costs are calculated according to what is made available by the project for society to enjoy and what society must give up in order to reap the project benefits. From this point of view, indirect taxes and subsidies are merely monetary transfers among members of the public and are thus dropped from the calculations. The other major adjustment made is to replace market wage rates with shadow wage rates in the calculation of labour costs for a project. This is done in order that the labour costs assigned to a project actually reflects the social opportunity cost of labour. The NPV then calculated in the Economic Analysis gives a measure of the acceptability of a project from society's point of view as opposed to the purely private perspective taken in the Financial Analysis.

2.4 Benefits and Costs at the Margin

Another aspect of the care required in defining the benefits and costs of projects implemented under the Agreement deserves comment. The objective of this evaluation is to assess whether the additional resources devoted to agricultural activities in Nova Scotia as a result of the Subsidiary Agreement will generate benefits of equal or greater value. Emphasis must be placed on the word additional. Special care has been taken to insure that the costs and benefits attributed to a project in this report are incremental to whatever was already taking place in agriculture. Another way of stating this is to say that attention has been focused on the marginal benefits and the marginal costs associated with a particular project.

2.5 Project Definition and Incrementality

In order to evaluate the relative success of a Subsidiary Agreement project it must be defined precisely enough that its benefits and costs can actually be calculated. Given the wide variety amongst Agreement participants and the great scope for alternative implementation arrangements, this proved to be no small problem. The approach adopted in this study is to define a "typical" undertaking at the micro or individual farmer level. The results of the analysis of this "typical" project are then scaled up to represent the result of the whole project for Nova Scotia. This procedure raises two questions. First, on what basis can a "typical" micro project be defined? Second, are the aggregate results calculated all incremental, or would part of the activity have occurred even in the absence of the incentives offered under the Agreement? Both of these questions are discussed in the remainder of this section.

Definition of a "typical" new project is based on the characteristics of participants in the Sub-Agreement programs revealed in the 1979 sample survey. Thus, for example, in the analysis of the land clearing portion of land development, a 21-acre clearing project is assumed, this number being the average size plot cleared under the program. In the operation of the new land, several different cropping rotations are assumed. These too are based on the cropping adoptions of Agreement participants captured in the sample survey.

To reach an estimate of the total contribution of a particular Agreement project, the net result for the "typical" project is scaled up by the number of participants recorded for that project. Such a procedure is justified by the well-known property that the value for a variable multiplied by the number of observations in a sample (or a population) will give the aggregate value for that variable applicable to the sample (population). Thus, for example, if the "typical" operation undertaken under Project A yields a NPV of 10 and there are 23 participants in Project A, the aggregate NPV attributable to project would be 230.

This value may, however, be an overestimate of the true contribution to new economic activity made by the project. To the extent that some resources used in the project would have been used for the same purpose over the same time period even in the absence of the incentives offered under the Agreement, the net benefits generated by these resources cannot be attributed to the project. In other words, society would have enjoyed those benefits even without the project. In the calculation of net or incremental aggregate benefits attributable to each project within the Agreement, an adjustment is therefore made to allow for the proportion of project activity that would have occurred anyway. For the major projects covered by the participants survey this adjustment is based on the probable participant behaviour revealed in the survey. For the smaller projects not covered in the survey, incremental effects are estimated from an assessment of the economic and business environment in which the project was undertaken.

2.6 Inter-Project Comparisons

A precautionary note must be added concerning the use of the NPV or the BCR for comparing the relative success of different projects within the Agreement. Neither criterion is intended for such comparisons and it would be invalid to use them in such a manner. Two aspects of this problem should be noted.

In the first place, two characteristics of the criteria themselves undermine any attempt at inter-project comparisons. First, use of the NPV criterion for inter-project comparisons runs afoul because of the sensitivity of the criterion to project scale. If all project benefits and costs are doubled, the value of the NPV will double too. Hence, inter-project comparisons using NPV can only be meaningful if exactly the same capital investment is made on each project in the first place. Second, the BCR value generated by a project is dependent on the definitions of benefits and costs employed. In some cases, a particular variable may be treated as either a cost or a negative benefit. The resultant BCR depends on which choice is made. Thus, drawing conclusions concerning the worth of one project relative to another is unjustified.

The second and overriding factor is that in the analysis undertaken both criteria are used to provide a measure of how well a project performs in the use of capital committed to it. Project performance is compared to the best alternative use of capital, assumed for the base case analysis to be 10 percent real rate of return. Therefore, this is the only valid use of the NPV's and BCR's reported in this study.

2.7 Economic Impact Analysis

An alternative approach to assessing the economic impact of a project is to estimate the employment and income generated. This is primarily a counting exercise which provides interesting and often highly sought after information. However it should be recognized that by dealing with only one aspect of a project, employment and the associated income, this type of analysis does not provide an adequate criterion on which to accept or reject a project, or a basis on which to judge whether a project has been a success. This can only be done by considering all aspects of a project including capital inputs and project outputs as well as labour. The latter is what the NPV calculation does and is the major reason why it is used in this evaluation exercise.

Turning to what we are calling economic impact assessment, the methodological procedures are straightforward. The first step is to estimate the Direct Employment generated by a project. The income associated with this employment is calculated by multiplying by the relevant wage rate. Such estimates are available from the Financial Analysis previously completed. A second, indirect source of employment and income associated with a project arises from purchases of goods and services used in the construction or operation of a project. Deriving such estimates on a commodity-by-commodity basis requires detailed information about producers and suppliers at a level which is generally unavailable, at least at reasonable cost. Consequently, it was decided to use a sector approach with sectors identified according to the 1974 Nova Scotia Input Output System. The indirect income and employment is derived by multiplying these expenditure values by the appropriate income and employment multipliers from the Input Output System. Adding these employment and income values to the previous estimates of direct employment and income yields an estimate of the total employment and income associated with the first round of project spending in any one year.

These estimates are derived in two parts, one part relating to the construction phase of a project and the other part covering the operating phase. Such a distinction is important because the construction phase lasts only one or two years at the most. In this sense its effect is temporary, unlike the operation phase which continues over the 20 year project life span.

Respending of the incomes generated directly and indirectly by a project may induce additional income and employment in other parts of the economy. This is often referred to as "multiplier effect." In this study the induced effects of project expenditure are calculated by multiplying the first round or exogenous sectoral employment and income by the appropriate sector multiplier from the Nova Scotia Input Output System.

Before making this calculation, however, it is necessary to estimate the incremental portion of project expenditure. That is, what part of the income and employment associated with a project occurs only because the project was implemented. Following the previously described methods for assessing incrementality, the incremental employment and income effects are multiplied by appropriate multipliers to estimate the induced employment and income.

CHAPTER THREE

3.0 Programme/Project Evaluation

3.1 Outline

The programmes/projects appear in the order in which they were listed in the Subsidiary Agreement. In each case the analysis has been set out according to the following format:

1.0 Project Title

1.1 Sector Profile

1.2 Project Description

- 1.2.1 Objectives
- 1.2.2 Project Performance
- 1.2.3 Participant Profile

1.3 Methodology

- 1.3.1 Methodological Issues
- 1.3.2 Assumptions

1.4 Results

- 1.4.1 Cost-Benefit Analysis
- 1.4.2 Incrementality
- 1.4.3 Financial Analysis
- 1.4.4 Cost-Benefit vs. Financial Analysis
- 1.4.5 Sensitivity Analysis

I. LAND DEVELOPMENT PROGRAMME

1.0 Land Clearing and Improvement

1.1 Sector Profile

From Table 1-1 it can be seen that the number of agricultural holdings and total farm area have both declined significantly over the twenty-five year period 1951-1976. The number of agricultural holdings was reduced by a total of 77 percent over this period. Similarly, total farm area decreased by a total of 62 percent over this same period.

These reductions have been attributed to two major factors. In the case of agricultural holdings the inability of the small farmer to be economically viable has been cited as a major contributor to the declining numbers. As for the reduction in total farm area over the period 1951-1976 urban sprawl and the declining number of farm holdings have been indicated as prominent factors.

However, these broad statistics disguise an important change that occurred between 1971-1976. Table 1-1 indicates that improved land in crops increased in acreage by 13.6 percent over this five year period. This is significant in that this increase is counter to a firmly established trend of twenty years. Suggested reasons for this turn-around were the provincial government land clearing, improvement, leasing and banking programs in place at that time which enabled existing farmers to enlarge their land bases.

1.2 Project Description

1.2.1 Objectives

The Land Development Programme is regarded, in a general sense, as a foundation for other projects in the Subsidiary Agreement. The Programme is designed to increase the area and productive capacity of the agricultural land base in Nova Scotia. This is to be achieved through provision of grants to farmers to assist in land clearing and improvement.

It was anticipated that 50,000 acres would be cleared and improved to the point of seeding, and another 50,000 acres would be improved over the five year duration of the Programme.

Expected benefits were three-fold:

a) development of fields amenable to the economic use of time and machinery;

b) development of new land to the crop production stage; and,

c) improvement of existing cleared land to increase its production potential and allow upgrading of the type of crop grown.

Qualification for grant assistance is limited to two conditions:

a) applicants must have obtained more than 50 percent of their gross income from the sale of agricultural production from their own farms or, have had agricultural production valued in excess of $5,000;

b) land must have been owned by the farmer, partnership, or company, or under long term lease.

The scope of assistance available is a subsidy based generally on 75 percent of allowable costs. These allowable costs, subject to specifications and conditions set forth in the Policy, aré based on actual costs to the applicant and in accordance with machine rates set by the Nova Scotia Department of Agriculture and Marketing. The maximum subsidy payable under this Programme to any one applicant during a fiscal year is deemed to be $18,000.

The estimated five year cost of the Programme was $26 million to be divided as follows:

Federal Share	Provincial Share	Producers' Share
$17,120,000	$4,280,000	$4,600,000

1.2.2 Project Performance

The number of acres cleared and improved, and costs incurred over the first four years of the Programme are summarized in Tables 1-2 and 1-3. From Table 1-2 it is ascertained that approximately 60 percent of the estimated five

Table 1-1

Number of Agricultural Holdings, Acreage of Improved and Unimproved Land
Nova Scotia 1951 - 1976

	Agricultural Holdings Number	Total Farm Area acres	Total Farm Area %Δ	Improved Land Total (acres)	Improved Land Crops[1] (acres)	Improved Land %Δ	Unimproved Land Total acres
1976	5,434	1,218,953		416,808	275,934		802,145
			- 8.3			+13.6	
1971	6,008	1,328,875		386,021	242,959		942,854
			-28.2			-22.7	
1966	9,621	1,851,895		485,859	314,143		1,366,036
			-17.0			- 4.5	
1961	12,518	2,230,395		497,521	329,114		1,732,874
			-19.6			-20.9	
1956	21,075	2,775,642		629,874	416,235		2,145,768
			-12.5			-12.8	
1951	23,515	3,173,691		661,975	477,459		2,511,716

Source: Province of Nova Scotia, Agricultural Statistics 1978, Table 32, Department of Agriculture and Marketing.

Notes: 1. includes field, vegetable, fruit, and nursery crop land.

Table 1-2

Land Development Programme
Total Combined Government and Farm Share Expenditures Incurred
1976 - 1979

Project	Government Share %[1]	Government Share ($'000)	Farm Share %	Farm Share ($'000)	Combined Expenditures All Farms ($'000)
Land Clearing	58.3	5,557.3	41.7	3,974.9	9,532.2
Land Improvement:					
a) surface ditching	70.9	767.8	29.1	315.1	1,082.9
b) land forming	78.6	624.9	21.4	170.1	795.0
c) under drainage	76.2	1,977.9	23.8	617.8	2,595.7
d) farm ponds	59.6	325.1	40.4	220.4	545.5
e) dykeland roads	71.6	50.7	28.4	20.1	70.8
f) land levelling	68.9	733.2	31.1	330.9	1,064.1
TOTAL		10,036.9		5,649.3	15,686.2

Source: Annual Reports, Survey

Notes: 1. Percentage shares of combined expenditure by the government and farm sectors were determined from the Survey.

2. Government expenditures were determined from the Annual Reports.

Table 1-3

Land Development Programme
Work Done 1976 - 1979

	Land Clearing	Land Improvement							
		Surface Ditching[1]		Under Drainage[2]		Land Levelling[3]	Land Forming	Total[4]
		feet	acres	feet	acres	acres	acres	acres
1976	5,463	361,965	1,040	621,169	893	258	656	2,847
1977	4,419	670,865	1,928	953,359	1,370	1,102	623	5,023
1978	7,825	1,099,914	3,161	1,158,714	1,665	2,849	1,351	9,026
1979	4,281	1,023,757	2,942	1,727,377	2,482	1,219	745	7,388
TOTAL	21,988	3,156,501	9,071	4,460,619	6,410	5,428	3,375	24,284

Source: Annual Reports

Notes:
1. Surface ditching feet to acres based on a conversion factor of 1 acre for every 348 feet of ditching. Source: Sorflaten

2. Under drainage feet to acres based on a conversion factor of 1 acre for every 695.9 feet of under drainage. Source: Brighton, R.S., "Land Drainage in Canada" *Macdonald Journal*, (October, 1975), pp. 6-10.

3. Acres of land levelled estimated using combined government grants and farm sector expenses at $196 per acre. Source: Sorflaten.

4. Summation of surface ditching, under drainage, land levelling and land forming.

year cost has been expended. This figure does not precisely reflect the intended 75:25 government-producer cost sharing ratio. In fact, the Survey indicates (noted in Table 1-2) that in many instances the producer outlay was greater than 25 percent of total allowable costs.

With respect to the stated objectives of 50,000 acres cleared and another 50,000 improved, Table 1-3 gives an indication of the progress made at the end of the first four years. A total of 21,988 acres have been cleared which represents approximately 44 percent of the stated land clearing objective. In the case of land improvement it has been assumed that 24,284 acres have been improved which represents a 49 percent achievement rate after four years. It appears that the Programme will fall short of its stated objectives after five years.

1.2.3 Participant Profile

A profile of the average participant, based on information contained in the Survey, is presented in Table 1-4. This information covers the first three years of the Programme and is based on a sample of 144 producers, approximately 10 percent of the total participants (1,475) up to that point. The information presented here provides a rough indication only of the average operation. For a more detailed description of participants see Sorflaten 1980.

The most significant points to note from the Survey about the average participants in the Land Development Programme are as follows:

a) average amount expended on land clearing was $8,289.95;
b) of monies expended on land improvement under drainage accounted for 44 percent, land forming 20 percent, surface ditching 19 percent, followed by land levelling at 9.3 percent, farm ponds 6 percent, and roads and dykelands at .7 percent;
c) the farm employed 1.87 persons;
d) off-farm work was relatively high;

Table 1-4

Profile of Average Participant
Land Development Programme

Item	Number of Responses	Average Measure	Average Percentage
1. Age of Operator	140	48.57 years	
2. Type of farm: family	127		
partnership	11		
3. Total land area operated	144	419.28 acres	
4. Value of land and buildings	142	$209,608.45	
5. Value of machinery and equipment	144	$53,873.07	
6. Total cattle and calves	118	83.21 head	
7. Cows and heifers for milking	62	60.85 head	
8. Total pigs	29	385.83 head	
9. Sows for breeding purposes	8	49.5 head	
10. Total sheep and lambs	18	197 head	
11. Total chickens	26	15,861.15 birds	
12. Labour: Employees	45	1.87 persons	
Week paid labour - male	99	60.71 weeks	
female	9	45.89 weeks	
13. Off-farm work	38	152.26 days	
14. Value of products sold:			
0 - 24,999	58		41.1
25,000 - 49,999	19		13.5
50,000 - 74,999	16		11.3
75,000 and over	48		34.0

e) participation was dominated by those with sales below $24,999 and those above $75,000;

f) participants were primarily dairy (62) and beef farmers (56) followed by hogs (29) of a sample size of 144;

g) of those who improved their land, 43.5 percent changed their cropping pattern;

h) 20.1 percent of the 144 producers who responded to this question indicated they would have undertaken the project without assistance.

1.3 Methodology

1.3.1 Methodological Issues

In general, the method used in the Cost-Benefit Analysis of the Land Development Programme adheres to the approach outlined in Chapter Two. The Land Development Programme is comprised of two separate programmes, namely Land Clearing and Land Improvement. The incremental capital and operating costs and revenues were estimated using historical data and by simulating the cost and revenue impact of either bringing additional acres into production, or by changing the cropping pattern of land already in production as a result of land improvements. A twenty year evaluation period was employed to examine these incremental effects. The results of the analyses were generalized to all participating producers and an adjustment made for incrementality in order to assess the performance of the overall programme.

1.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis.

a) Unit Size: All cost and benefit estimates are based on:

i) land clearing - 21 acres of land cleared, the average amount cleared according to the Survey, and subsequent cropping patterns;

ii) land improvement - 9 acres of land improved, an average representative of the amount improved by participants, and subsequent cropping patterns.

b) Base Year: all cost and benefit projections are expressed in 1978 constant dollars.

c) Crop Rotations:

Land Clearing - three rotations were chosen. The first two rotations are cattle oriented and the third is grains oriented.

i) Cattle Rotation 1:

pasture	2 years
grass hay	1 year
barley	2 years
grass hay	3 years

- barley and grass hay rotate from year 5 on.

ii) Cattle Rotation 2:

alfalfa hay	3 years
oats	1 year
corn silage	2 years

- cycle repeats in total

iii) Grain Rotation:

grain corn	1 year
barley	1 year
winter wheat	1 year

- cycle repeats in total

Land Improvement - four rotations were chosen. The first three rotations assumed that tame hay was being grown prior to land improvement and the fourth assumes that the land was fallow prior to improvement.

i) Rotation 1: original crop tame hay, after improvement -

alfalfa	3 years
oats	1 year
corn silage	2 years

- cycle after improvement repeats

ii) Rotation 2: original crop tame hay, after improvement - remains in tame hay

iii) Rotation 3: original crop tame hay, after improvement -

winter wheat	1 year
barley	1 year
grain corn	1 year

- cycle after improvement repeats

iv) Rotation 4: land fallow before improvement. After improvement -

oats	2 years
alfalfa	3 years
oats	1 year
corn silage	2 years

- cycle from alfalfa on repeats

d) Investment Costs

i) Land Clearing and Improvement Costs

Land clearing: land clearing costs were assumed to be $450/acre or $9450/21 acres. This cost includes all preparations to the land up to the point of seeding. This figure is based on a cost sharing ratio of a 58.3 percent government outlay and a 41.7 percent producer outlay. This ratio was extracted from the Survey. It has been reported that the producer outlay may be as high as 70 percent. However, it does appear that the $450/acre land clearing cost is reasonable.

Land improvement: land improvement costs were assumed to be $225/acre or $2025/9 acres. This cost is actually a weighted average of the four major land improvement activities, namely surface ditching, under drainage, land forming and land levelling. The weighted average is based on the number of acres improved by the aforementioned activities. The government-producer cost sharing ratio roughly follows the 75:25 format stated in Shcedule "A".

ii) Machinery and Equipment: requirements for, and costs of machinery and equipment were derived from the 1978 Farm Management Advisory Manual. It was assumed that all machinery was at its half-life in year 1 of of the evaluation. Machinery and equipment costs were allocated on a proportional basis to the number of acres cleared or improved. For 21 acres land cleared machinery and equipment costs are allocated at 10 percent of costs. For 9 acres land improved costs are allocated at 4.5 percent. Percentages are based on 200 acres being farmed.

e) Operating Costs:

i) production: production costs for the various crops were derived from the 1978 Farm Management Advisory Manual.

ii) harvest: harvest costs for the various crops were derived from the 1978 Farm Management Advisory Manual.

iii) labour: labour costs were derived from the production and harvest costs and separated from them. Labour was valued at $3.50 per hour.

iv) other: other costs include machinery repair and insurance expenses. These costs were calculated according to the methodology presented in the Farm Management crop sheets.

f) Benefits:

i) Sales: all sales projections for the Land Clearing and Improvement Programmes are based on the following yield per acre and value per tonne figures. The yield per acre is measured in tonnes, with the exception of pasture which is valued from the point of view of being able to support 1.33 cows per acre over the pasture season. The value per tonne is structured on a feed replacement basis. The basic sources of information on yield and value data were crop specialists and Farm Management publications.

The following yields per acre and value per ton were assumed for the crops used in the Land Clearing and Improvement rotations.

	Yield per acre (tonnes)	Value/Tonne ($ 1978)
i) grass hay	3	50
ii) barley	1	123.45
iii) alfalfa hay	4.1	50
iv) oats	.9	131.54
v) corn silage	13.5	18
vi) grain corn	1.5	147.17
vii) winter wheat	1.5	155.39
viii) pasture - a value of $144.60/acre is assumed		

In the case of all rotations, except for improved land remaining in grass hay, crop yields increased over time. A 1 percent increase is assumed for years 1-10 and a .5 percent increase is assumed from year 10 on. This is designed to reflect land being brought up to potential. With respect to the Land Improvement rotation which remains in tame hay for 20 years, yields increase by 2 percent per year until year 4 and after that decline by 1 percent until year 20. Sales are thus adjusted accordingly in all instances.

ii) subsidy: there are two subsidies accounted for in the evaluation of Land Development Programme. With respect to the Land Clearing and Land Improvement Programmes, they are as follows:

Land Clearing

- capital costs subsidy: based on land clearing charges of $9450 for 21 acres. A 58.3:41.7 government-producer cost sharing ratio implies a subsidy of $5509.35 in year 1.
- fertilizer and limestone subsidy: derived from Nova Scotia Department of Agriculture and Marketing Policies numbers 4 and 20. Requirements for fertilizer and limestone acres were derived from Farm Management sources. A total subsidy of $253.01 for 21 acres is implied.

Land Improvement

- capital costs subsidy: based on land improvement charges of $2025 for 9 acres. A 72.8:27.2 government-producer cost sharing ratio implies a subsidy of $1476.18 in year 1.
- fertilizer and limestone subsidy: similar to the above in nature. A total subsidy of $102.20 for 9 acres is implied.

iii) other: other benefits were the salvage value received for expended machinery and equipment. A salvage value of 10 percent of the cost of replacement was assumed.

1.4 Results

1.4.1 Cost-Benefit Analysis

The Land Development Programme is comprised of two distinct projects, namely Land Clearing and Land Improvement. For each project various crop rotations are used to simulate the production of acres cleared and improved.

A. LAND CLEARING

The costs and benefits associated with the clearing of 21 acres of land and subsequent crop patterns are presented in three base cases in Tables 1-5, 1-6 and 1-7. The analyses indicate that the project will yield the following results:

			Net Present Value	Benefit-Cost Ratio
Rotation 1:	pasture	2 years		
	grass hay	1 year		
	barley	2 years	($421)	.85
	grass hay	3 years		
	- barley and grass rotate			
Rotation 2:	alfalfa hay	3 years		
	oats	1 year	$2,090	1.07
	corn silage	2 years		
Rotation 3:	grain corn	1 year		
	barley	1 year	($510)	.98
	winter wheat	1 year		

The base case result is for a 21 acre plot of land cleared. We estimate that over the first four years of the programme the equivalent of 1047 such projects were undertaken. In order to gross the net present value of the project up to the programme level it is assumed that 25 percent of the participants plant rotation 1 and 75 percent of the participants plant rotation two. This assumption reflects the relative profitability of the rotations and the notion that a farmer is a profit maximizer. The programme as a whole will yield the following results:

Table 1-5

ECONOMIC APPRAISAL OF A 21 ACRE LAND CLEARING PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: CATTLE ROTATION 1 (PASTURE 2 YR;
HAY 1 YR; BARLEY 2 YR; HAY 3 YR;
LAST COMBINATION REPEATS FROM YR 5 ON)

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSIDY	OTHER	COST	BENEFIT	NETFLOW
1	9.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.45	0.00	-9.45
2	0.00	0.00	1.30	0.00	0.00	.11	3.04	0.00	0.00	1.40	3.04	1.64
3	0.00	0.00	1.30	0.00	0.00	.11	3.04	0.00	0.00	1.40	3.04	1.64
4	0.00	0.00	1.23	.39	.19	.30	3.15	0.00	0.00	2.11	3.15	1.04
5	0.00	0.00	1.27	.59	.24	.29	2.59	0.00	0.00	2.39	2.59	.20
6	0.00	.22	1.27	.59	.24	.29	2.62	0.00	-.02	2.61	2.64	.03
7	0.00	1.81	1.23	.39	.19	.30	3.13	0.00	.19	3.92	3.38	-.54
8	0.00	1.43	1.23	.39	.19	.30	3.21	0.00	.14	3.54	3.36	-.19
9	0.00	1.43	1.23	.39	.22	.30	3.24	0.00	.14	3.58	3.39	-.19
10	0.00	0.00	1.27	.59	.30	.29	2.64	0.00	0.00	2.45	2.64	.19
11	0.00	.59	1.27	.59	.22	.29	2.67	0.00	0.00	2.97	2.67	-.30
12	0.00	0.00	1.23	.39	.27	.30	3.28	0.00	0.00	2.19	3.28	1.09
13	0.00	0.00	1.23	.39	.29	.30	3.31	0.00	0.00	2.21	3.31	1.10
14	0.00	0.00	1.23	.39	.22	.30	3.34	0.00	0.00	2.21	3.34	1.13
15	0.00	0.00	1.27	.59	.36	.29	2.70	0.00	0.00	2.51	2.70	.18
16	0.00	.22	1.27	.59	.36	.29	2.72	0.00	.02	2.73	2.74	.01
17	0.00	0.00	1.23	.39	.29	.30	3.37	0.00	0.00	2.21	3.37	1.16
18	0.00	0.00	1.23	.39	.22	.30	3.40	0.00	0.00	2.21	3.40	1.20
19	0.00	1.81	1.23	.39	.22	.30	3.42	0.00	.19	4.01	3.62	-.40
20	0.00	0.00	1.27	.59	.36	.29	2.75	0.00	0.00	2.51	2.75	.24

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -4.21

Table 1-6

ECONOMIC APPRAISAL OF A 21 ACRE LAND CLEARING PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: CATTLE ROTATION 2 (ALFALFA HAY,3YR;
OATS 1 YR; CORN SILAGE 2 YR;
CYCLE REPEATS)

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	9.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.45	0.00	-9.45
2	0.00	0.00	1.56	.39	.19	.33	4.31	0.00	0.00	2.47	4.31	1.84
3	0.00	0.00	1.56	.39	.19	.31	4.35	0.00	0.00	2.44	4.35	1.90
4	0.00	0.00	1.55	.39	.19	.31	4.39	0.00	0.00	2.44	4.39	1.95
5	0.00	0.00	1.18	.63	.24	.29	2.49	0.00	0.00	2.34	2.49	.15
6	0.00	.22	1.74	.34	.27	.36	5.10	0.00	.02	2.93	5.13	2.19
7	0.00	1.81	1.74	.34	.27	.36	5.15	0.00	.18	4.52	5.33	.82
8	0.00	2.10	1.55	.39	.19	.33	4.43	0.00	.21	4.57	4.64	.07
9	0.00	2.10	1.55	.39	.22	.31	4.47	0.00	.21	4.58	4.68	.10
10	0.00	0.00	1.55	.39	.24	.31	4.52	0.00	0.00	2.49	4.52	2.02
11	0.00	.50	1.18	.63	.32	.29	2.51	0.00	0.00	2.92	2.51	-.41
12	0.00	0.00	1.74	.34	.38	.36	5.21	0.00	0.00	2.82	5.21	2.38
13	0.00	0.00	1.74	.34	.40	.36	5.25	0.00	0.00	2.84	5.25	2.41
14	0.00	0.00	1.55	.39	.29	.33	4.52	0.00	0.00	2.55	4.52	1.95
15	0.00	0.00	1.56	.39	.29	.31	4.56	0.00	0.00	2.54	4.56	2.02
16	0.00	.23	1.55	.39	.29	.31	4.60	0.00	.02	2.75	4.62	1.86
17	0.00	0.00	1.18	.63	.36	.29	2.54	0.00	0.00	2.45	2.54	.08
18	0.00	0.00	1.74	.34	.40	.36	5.31	0.00	0.00	2.84	5.31	2.47
19	0.00	1.81	1.74	.34	.40	.36	5.35	0.00	1.18	4.65	6.54	1.89
20	0.00	0.00	1.55	.39	.29	.33	4.64	0.00	0.00	2.56	4.64	2.08

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 2.09

Table 1-7

ECONOMIC APPRAISAL OF A 21 ACRE LAND CLEARING PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: GRAIN ROTATION (GRAIN CORN,1YR:
BARLEY 1 YR: WINTER WHEAT 1 YR:
CYCLE REPEATS)

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	9.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.45	0.00	-9.45
2	0.00	0.00	1.74	.99	.21	.35	4.64	0.00	0.00	3.29	4.64	1.35
3	0.00	0.00	1.27	.59	.24	.29	2.59	0.00	0.00	2.39	2.59	.20
4	0.00	0.00	1.30	.67	.24	.30	4.89	0.00	0.00	2.51	4.89	2.38
5	0.00	0.00	1.74	.99	.21	.35	4.69	0.00	0.00	3.29	4.69	1.40
6	0.00	.22	1.27	.59	.24	.29	2.62	0.00	.02	2.61	2.64	.03
7	0.00	.14	1.30	.67	.24	.30	4.94	0.00	.01	2.65	4.96	2.31
8	0.00	1.67	1.74	.99	.21	.35	4.73	0.00	.17	4.96	4.90	-.06
9	0.00	1.67	1.27	.59	.28	.29	2.64	0.00	.17	4.10	2.81	-1.29
10	0.00	0.00	1.30	.67	.30	.30	4.99	0.00	0.00	2.57	4.99	2.42
11	0.00	1.00	1.74	.99	.27	.35	4.77	0.00	0.00	4.35	4.77	.42
12	0.00	0.00	1.27	.59	.34	.29	2.67	0.00	0.00	2.49	2.67	.18
13	0.00	0.00	1.30	.67	.36	.30	5.04	0.00	0.00	2.63	5.04	2.41
14	0.00	0.00	1.74	.99	.31	.35	4.82	0.00	0.00	3.39	4.82	1.43
15	0.00	0.00	1.27	.59	.36	.29	2.70	0.00	0.00	2.51	2.70	.18
16	0.00	.22	1.30	.67	.36	.30	5.09	0.00	.02	2.85	5.11	2.26
17	0.00	0.00	1.74	.99	.31	.35	4.87	0.00	0.00	3.39	4.87	1.48
18	0.00	0.00	1.27	.59	.36	.29	2.72	0.00	0.00	2.51	2.72	.21
19	0.00	.14	1.30	.67	.36	.30	5.14	0.00	.01	2.77	5.15	2.39
20	0.00	0.00	1.74	.99	.31	.35	4.91	0.00	0.00	3.39	4.91	1.53

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -.51

Rotation 1: (\$421) x .25 x 1047 = \$ (110,196.75)
Rotation 2: \$2,090 x .75 x 1,047 = \$1,641,172.50
\$1,530,975.75

Programme Net Present Value - \$1,530,975.75

The results indicate that from the point of view of society as a whole, the programme to date has been worthwhile.

B. LAND IMPROVEMENT

The costs and benefits associated with the improvement of 9 acres of land and subsequent crop patterns are presented in four base cases in Tables 1-8, 1-9, 1-10 and 1-11. The analyses indicate that the project will yield the following results:

		Net Present Value	Benefit-Cost Ratio
Rotation 1:	alfalfa 3 years oats 1 year corn silage 2 years	\$2,460	1.21
Rotation 2:	remains in tame hay	\$ 300	1.03
Rotation 3:	winter wheat 1 year barley 1 year grain corn 1 year	\$1,720	1.14
Rotation 4:	oats 2 years alfalfa 3 years oats 1 year corn silage 2 years - cycle from alfalfa on repeats	\$1,260	1.11

The base case result is for a 9 acre plot of land which has been improved. In this project there is an implicit opportunity cost in that the land was producing tame hay prior to the improvements. To gain a more accurate understanding of the benefits associated with the project it is necessary to set out the opportunity cost (net present value of land remaining in tame hay) from an intermediate net present value representing the other three crop rota-

Table 1-8

ECONOMIC APPRAISAL OF A 9 ACRE LAND IMPROVEMENT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: ORIGINAL CROP-TAME HAY;AFTER
LAND IMPROVEMENT-ALFALFA, 3YR; OATS, 1YR;
CORN SILAGE, 2YR;ROTATION CYCLE REPEATS

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	-2.03
2	0.00	0.00	.67	.17	.08	.15	1.85	0.00	0.00	1.06	1.85	.78
3	0.00	0.00	.67	.17	.08	.15	1.86	0.00	0.00	1.06	1.86	.80
4	0.00	0.00	.67	.17	.08	.15	1.88	0.00	0.00	1.06	1.88	.82
5	0.00	0.00	.51	.27	.10	.13	1.07	0.00	0.00	1.01	1.07	.06
6	0.00	.10	.75	.14	.12	.16	2.19	0.00	.01	1.27	2.20	.93
7	0.00	.81	.75	.14	.12	.16	2.21	0.00	.08	1.98	2.29	.31
8	0.00	.95	.67	.17	.08	.15	1.90	0.00	.09	2.01	1.99	-.02
9	0.00	.95	.67	.17	.10	.15	1.92	0.00	.09	2.02	2.01	-.01
10	.19	0.00	.67	.17	.10	.15	1.94	0.00	0.00	1.27	1.94	.66
11	0.00	.23	.51	.27	.14	.13	1.08	0.00	0.00	1.27	1.08	-.19
12	0.00	0.00	.75	.14	.16	.16	2.25	0.00	0.00	1.21	2.25	1.04
13	0.00	0.00	.75	.14	.17	.16	2.28	0.00	0.00	1.22	2.28	1.05
14	0.00	0.00	.67	.17	.12	.15	1.95	0.00	0.00	1.10	1.95	.85
15	0.00	0.00	.67	.17	.12	.15	1.97	0.00	0.00	1.10	1.97	.87
16	0.00	.10	.67	.17	.12	.15	1.99	0.00	.01	1.20	2.00	.79
17	0.00	0.00	.51	.27	.16	.13	1.09	0.00	0.00	1.06	1.09	.03
18	0.00	0.00	.75	.14	.17	.16	2.30	0.00	0.00	1.22	2.30	1.07
19	.19	.81	.75	.14	.17	.16	2.32	0.00	.10	2.23	2.42	.20
20	0.00	0.00	.67	.17	.12	.15	2.01	0.00	0.00	1.10	2.01	.90

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 2.46

Table 1-9

ECONOMIC APPRAISAL OF A 9 ACRE LAND IMPROVEMENT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: NO CHANGE IN LAND USE-
TAME HAY BEFORE AND
AFTER IMPROVEMENT

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	-2.03
2	0.00	0.00	.55	.17	.08	.14	1.35	0.00	0.00	.94	1.35	.41
3	0.00	0.00	.55	.17	.08	.14	1.38	0.00	0.00	.94	1.38	.44
4	0.00	0.00	.55	.17	.08	.14	1.40	0.00	0.00	.94	1.40	.47
5	0.00	0.00	.55	.17	.08	.14	1.43	0.00	0.00	.94	1.43	.49
6	0.00	.05	.55	.17	.08	.14	1.42	0.00	.00	.98	1.43	.44
7	0.00	.81	.55	.17	.08	.14	1.41	0.00	.08	1.75	1.49	-.26
8	0.00	.62	.55	.17	.08	.14	1.40	0.00	.06	1.55	1.47	-.09
9	0.00	.62	.55	.17	.10	.14	1.40	0.00	.06	1.57	1.46	-.11
10	.19	0.00	.55	.17	.10	.14	1.39	0.00	0.00	1.15	1.39	.24
11	0.00	0.00	.55	.17	.11	.14	1.38	0.00	0.00	.96	1.38	.41
12	0.00	0.00	.55	.17	.12	.14	1.37	0.00	0.00	.97	1.37	.40
13	0.00	0.00	.55	.17	.12	.14	1.36	0.00	0.00	.98	1.36	.38
14	0.00	0.00	.55	.17	.12	.14	1.35	0.00	0.00	.98	1.35	.37
15	0.00	0.00	.55	.17	.12	.14	1.34	0.00	0.00	.98	1.34	.36
16	0.00	.05	.55	.17	.12	.14	1.34	0.00	.00	1.02	1.34	.32
17	0.00	0.00	.55	.17	.12	.14	1.33	0.00	0.00	.98	1.33	.35
18	0.00	0.00	.55	.17	.12	.14	1.33	0.00	0.00	.98	1.33	.35
19	.19	.81	.55	.17	.12	.14	1.32	0.00	.08	1.98	1.40	-.57
20	0.00	0.00	.55	.17	.12	.14	1.32	0.00	0.00	.98	1.32	.34

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= .30

Table 1-10

ECONOMIC APPRAISAL OF A 9 ACRE LAND IMPROVEMENT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: ORIGINAL CROP-TAME HAY;AFTER
LAND IMPROVEMENT-WINTER WHEAT, 1YR: BARLEY, 1YR;
GRAIN CORN, 1YR;ROTATION CYCLE REPEATS

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	-2.03
2	0.00	0.00	.56	.29	.10	.13	2.10	0.00	0.00	1.08	2.10	1.02
3	0.00	0.00	.52	.28	.10	.13	1.11	0.00	0.00	1.03	1.11	.08
4	0.00	0.00	.75	.43	.09	.15	1.99	0.00	0.00	1.41	1.99	.57
5	0.00	0.00	.56	.29	.10	.13	2.13	0.00	0.00	1.08	2.13	1.05
6	0.00	.10	.52	.28	.10	.13	1.12	0.00	.01	1.13	1.13	-.00
7	0.00	.06	.75	.43	.09	.15	2.01	0.00	.01	1.47	2.01	.54
8	0.00	.75	.56	.29	.10	.13	2.14	0.00	.08	1.83	2.22	.38
9	0.00	.75	.52	.28	.12	.13	1.13	0.00	.08	1.81	1.21	-.60
10	.19	0.00	.75	.43	.11	.15	2.03	0.00	0.00	1.62	2.03	.40
11	0.00	.45	.56	.29	.14	.13	2.16	0.00	0.00	1.56	2.16	.60
12	0.00	0.00	.52	.28	.15	.13	1.14	0.00	0.00	1.08	1.14	.07
13	0.00	0.00	.75	.43	.13	.15	2.05	0.00	0.00	1.46	2.05	.59
14	0.00	0.00	.56	.29	.16	.13	2.18	0.00	0.00	1.13	2.18	1.05
15	0.00	0.00	.52	.28	.16	.13	1.16	0.00	0.00	1.09	1.16	.07
16	0.00	.10	.75	.43	.13	.15	2.07	0.00	.01	1.56	2.08	.52
17	0.00	0.00	.56	.29	.16	.13	2.20	0.00	0.00	1.13	2.20	1.07
18	0.00	0.00	.52	.28	.16	.13	1.17	0.00	0.00	1.09	1.17	.08
19	.19	.06	.75	.43	.13	.15	2.09	0.00	.01	1.70	2.09	.39
20	0.00	0.00	.56	.29	.16	.13	2.22	0.00	0.00	1.13	2.22	1.09

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1.72

Table 1-11

ECONOMIC APPRAISAL OF A 9 ACRE LAND IMPROVEMENT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: LAND FALLOW BEFORE IMPROVEMENT;
THEN OATS, 2YR; ALFALFA, 3YR; OATS. 1YR;
CORN SILAGE, 2YR;LAST ROTATION CYCLE REPEATS

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	-2.03
2	0.00	0.00	.51	.27	.10	.13	1.07	0.00	0.00	1.01	1.07	.06
3	0.00	0.00	.51	.27	.10	.13	1.08	0.00	0.00	1.01	1.08	.07
4	0.00	0.00	.67	.17	.08	.15	1.85	0.00	0.00	1.06	1.85	.78
5	0.00	0.00	.67	.17	.08	.15	1.86	0.00	0.00	1.06	1.86	.80
6	0.00	.10	.67	.17	.08	.15	1.88	0.00	.01	1.16	1.89	.73
7	0.00	.81	.51	.27	.10	.13	1.09	0.00	.08	1.82	1.17	-.65
8	0.00	.95	.75	.14	.12	.16	2.19	0.00	.09	2.11	2.28	.17
9	0.00	.95	.75	.14	.13	.16	2.21	0.00	.09	2.13	2.30	.17
10	.19	0.00	.67	.17	.10	.15	1.90	0.00	0.00	1.27	1.90	.63
11	0.00	.23	.67	.17	.11	.15	1.92	0.00	0.00	1.32	1.92	.60
12	0.00	0.00	.67	.17	.12	.15	1.94	0.00	0.00	1.10	1.94	.84
13	0.00	0.00	.51	.27	.16	.13	1.10	0.00	0.00	1.06	1.10	.04
14	0.00	0.00	.75	.14	.17	.16	2.23	0.00	0.00	1.22	2.23	1.01
15	0.00	0.00	.75	.14	.17	.16	2.25	0.00	0.00	1.22	2.25	1.03
16	0.00	.10	.67	.17	.12	.15	1.95	0.00	.01	1.20	1.96	.76
17	0.00	0.00	.67	.17	.12	.15	1.97	0.00	0.00	1.10	1.97	.87
18	0.00	0.00	.67	.17	.12	.15	1.99	0.00	0.00	1.10	1.99	.88
19	.19	.81	.51	.27	.16	.13	1.11	0.00	.08	2.06	1.19	-.87
20	0.00	0.00	.75	.14	.17	.16	2.28	0.00	0.00	1.22	2.28	1.05

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1.26

tions (Rotation 3). This will assess the benefits in a more realistic sense. We estimate that over the first four years of the programme the equivalent of 2698 such projects were undertaken. The programme as a whole will yield the following results:

Rotation 2 NPV - Rotation 3 NPV = $1,420
$1,420 x 2698 = $3,831,160
Net Present Value = $3,831,160

The results indicate from the perspective of society as a whole that the programme to date has been worthwhile. It must be noted that it is not possible to compare Net Present Values (NPV's) and Benefit-Cost Ratios (BCR's) across projects. This is due to the scale of the individual projects and the assumptions made about benefits and costs in each case.

1.4.2 Incrementality

A. LAND CLEARING

The gross net present value of $1,530,975.75 cannot be attributed exclusively to incentives provided under the programme. The Survey indicates that 20 percent of those participating would have undertaken the work without assistance. The implication of this finding is that the programme in fact contributed directly to the initiation of approximately 838 of the 21 acre land clearing projects. These projects would generate a NPV of $1,224,780.60.

B. LAND IMPROVEMENT

The gross net present value of $3,831,160 cannot be attributed solely to incentives provided under the programme. Survey data indicates that 20 percent of survey respondents would have done the work without assistance. This implies that the programme contributed directly to the initiation of approximately 2,159 of the 9 acre land improvement projects. These projects would generate a NPV of $3,065,780.

1.4.3 Financial Analysis

The financial analysis has been undertaken from the point of view of the private producer who actually makes the investment.

A. LAND CLEARING

The results using this approach are set out in Tables 1-12, 1-13, and 1-14. They are summarized as follows:

	Net Present Value	Benefit-Cost Ratio
Rotation 1	$ 940	1.03
Rotation 2	$ 7,000	1.22
Rotation 3	$ 4,360	1.13

B. LAND IMPROVEMENT

The results for the financial analysis of the Land Improvement project are set out in Tables 1-15, 1-16, 1-17 and 1-18. They are summarized as follows:

	Net Present Value	Benefit-Cost Ratio
Rotation 1	$ 4,320	1.35
Rotation 2	$ 2,210	1.21
Rotation 3	$ 3,550	1.29
Rotation 4	$ 3,110	1.26

1.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

Table 1-12

FINANCIAL APPRAISAL OF A 21 ACRE LAND CLEARING PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: CATTLE ROTATION 1 (PASTURE 2 YR;
HAY 1 YR; BARLEY 2 YR; HAY 3 YR;
LAST COMBINATION REPEATS FROM YR 5 ON)

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	9.45	0.00	0.00	0.00	0.00	0.00	0.00	4.19	0.00	9.45	4.19	-5.26
2	0.00	0.00	1.30	0.00	0.00	.11	3.04	.25	0.00	1.40	3.29	1.89
3	0.00	0.00	1.30	0.00	0.00	.11	3.04	.25	0.00	1.40	3.29	1.89
4	0.00	0.00	1.23	.39	.32	.30	3.15	.25	0.00	2.24	3.40	1.16
5	0.00	0.00	1.27	.59	.40	.29	2.59	.25	0.00	2.55	2.85	.29
6	0.00	.22	1.27	.59	.40	.29	2.62	.25	.02	2.77	2.89	.12
7	0.00	1.81	1.23	.39	.32	.30	3.19	.25	.19	4.05	3.63	-.42
8	0.00	1.43	1.23	.39	.32	.30	3.21	.25	.14	3.67	3.61	-.06
9	0.00	1.43	1.23	.39	.32	.30	3.24	.25	.14	3.67	3.64	-.03
10	0.00	0.00	1.27	.59	.40	.29	2.64	.25	0.00	2.55	2.90	.35
11	0.00	.50	1.27	.59	.40	.29	2.67	.25	0.00	3.05	2.92	-.13
12	0.00	0.00	1.23	.39	.32	.30	3.28	.25	0.00	2.24	3.53	1.29
13	0.00	0.00	1.23	.39	.32	.30	3.31	.25	0.00	2.24	3.56	1.32
14	0.00	0.00	1.23	.39	.32	.30	3.34	.25	0.00	2.24	3.59	1.35
15	0.00	0.00	1.27	.59	.40	.29	2.70	.25	0.00	2.55	2.95	.40
16	0.00	.22	1.27	.59	.40	.29	2.72	.25	.02	2.77	3.00	.22
17	0.00	0.00	1.23	.39	.32	.30	3.37	.25	0.00	2.24	3.62	1.39
18	0.00	0.00	1.23	.39	.32	.30	3.40	.25	0.00	2.24	3.66	1.42
19	0.00	1.81	1.23	.39	.32	.30	3.42	.25	.19	4.05	3.87	-.18
20	0.00	0.00	1.27	.59	.40	.29	2.75	.25	0.00	2.55	3.00	.45

NET PRESENT VALUE AT 10.00% DISCOUNT RATE = .94

Table 1-13

FINANCIAL APPRAISAL OF A 21 ACRE LAND CLEARING PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: CATTLE ROTATION 2 (ALFALFA HAY,3YR;
OATS 1 YR; CORN SILAGE 2 YR;
CYCLE REPEATS)

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	9.45	0.00	0.00	0.00	0.00	0.00	0.00	4.19	0.00	9.45	4.19	-5.26
2	0.00	0.00	1.56	.39	.32	.33	4.31	.25	0.00	2.59	4.56	1.96
3	0.00	0.00	1.55	.39	.32	.31	4.35	.25	0.00	2.57	4.60	2.03
4	0.00	0.00	1.56	.39	.32	.31	4.39	.25	0.00	2.57	4.64	2.07
5	0.00	0.00	1.18	.63	.40	.29	2.49	.25	0.00	2.50	2.74	.24
6	0.00	.22	1.74	.34	.45	.36	5.10	.25	.02	3.11	5.38	2.27
7	0.00	1.91	1.74	.34	.45	.36	5.15	.25	.18	4.70	5.59	.89
8	0.00	2.10	1.56	.39	.32	.33	4.43	.25	.21	4.70	4.89	.20
9	0.00	2.10	1.55	.39	.32	.31	4.47	.25	.21	4.68	4.94	.26
10	0.00	0.00	1.56	.39	.32	.31	4.52	.25	0.00	2.57	4.77	2.20
11	0.00	.50	1.18	.63	.40	.29	2.51	.25	0.00	3.00	2.77	-.23
12	0.00	0.00	1.74	.34	.45	.36	5.21	.25	0.00	2.89	5.46	2.57
13	0.00	0.00	1.74	.34	.45	.36	5.26	.25	0.00	2.89	5.51	2.62
14	0.00	0.00	1.56	.39	.32	.33	4.52	.25	0.00	2.59	4.77	2.17
15	0.00	0.00	1.56	.39	.32	.31	4.56	.25	0.00	2.57	4.81	2.24
16	0.00	.23	1.56	.39	.32	.31	4.60	.25	.02	2.80	4.87	2.08
17	0.00	0.00	1.18	.63	.40	.29	2.54	.25	0.00	2.50	2.79	.29
18	0.00	0.00	1.74	.34	.45	.36	5.31	.25	0.00	2.89	5.56	2.67
19	0.00	1.81	1.74	.34	.45	.36	5.35	.25	1.18	4.70	6.80	2.10
20	0.00	0.00	1.55	.39	.32	.33	4.64	.25	0.00	2.59	4.89	2.30

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 7.00

Table 1-14

FINANCIAL APPRAISAL OF A 21 ACRE LAND CLEARING PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: GRAIN ROTATION (GRAIN CORN, 1YR;
BARLEY 1 YR; WINTER WHEAT 1 YR;
CYCLE REPEATS)

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSIDY	OTHER	COST	BENEFIT	NETFLOW
1	9.45	0.00	0.00	0.00	0.00	0.00	0.00	4.19	0.00	9.45	4.19	-5.26
2	0.00	0.00	1.74	.99	.34	.35	4.64	.25	0.00	3.42	4.89	1.47
3	0.00	0.00	1.27	.59	.40	.29	2.59	.25	0.00	2.55	2.85	.29
4	0.00	0.00	1.30	.67	.40	.30	4.90	.25	0.00	2.67	5.15	2.48
5	0.00	0.00	1.74	.99	.34	.35	4.69	.25	0.00	3.42	4.94	1.51
6	0.00	.22	1.27	.59	.40	.29	2.62	.25	.02	2.77	2.89	.12
7	0.00	.14	1.30	.67	.40	.30	4.94	.25	.01	2.81	5.21	2.40
8	0.00	1.67	1.74	.99	.34	.35	4.73	.25	.17	5.10	5.15	.05
9	0.00	1.67	1.27	.59	.40	.29	2.64	.25	.17	4.23	3.06	-1.16
10	0.00	0.00	1.30	.67	.40	.30	4.99	.25	0.00	2.67	5.25	2.57
11	0.00	1.00	1.74	.99	.34	.35	4.77	.25	0.00	4.42	5.03	.61
12	0.00	0.00	1.27	.59	.40	.29	2.67	.25	0.00	2.55	2.92	.37
13	0.00	0.00	1.30	.67	.40	.30	5.04	.25	0.00	2.67	5.29	2.62
14	0.00	0.00	1.74	.99	.34	.35	4.82	.25	0.00	3.42	5.07	1.65
15	0.00	0.00	1.27	.59	.40	.29	2.70	.25	0.00	2.55	2.95	.40
16	0.00	.22	1.30	.67	.40	.30	5.09	.25	.02	2.90	5.37	2.47
17	0.00	0.00	1.74	.99	.34	.35	4.87	.25	0.00	3.42	5.12	1.70
18	0.00	0.00	1.27	.59	.40	.29	2.72	.25	0.00	2.55	2.98	.42
19	0.00	.14	1.30	.67	.40	.30	5.14	.25	.01	2.81	5.41	2.60
20	0.00	0.00	1.74	.99	.34	.35	4.91	.25	0.00	3.42	5.17	1.74

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 4.35

Table 1-15

FINANCIAL APPRAISAL OF A 9 ACRE LAND IMPROVEMEMT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: ORIGINAL CROP-TAME HAY;AFTER
LAND IMPROVEMENT-ALFALFA, 3YR; OATS, 1YR;
CORN SILAGE, 2YR;ROTATION CYCLE REPEATS

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	2.03	1.58	-.45
2	0.00	0.00	.67	.17	.14	.15	1.85	.10	0.00	1.12	1.95	.83
3	0.00	0.00	.67	.17	.14	.15	1.86	.10	0.00	1.12	1.97	.85
4	0.00	0.00	.67	.17	.14	.15	1.88	.10	0.00	1.12	1.98	.87
5	0.00	0.00	.51	.27	.17	.13	1.07	.10	0.00	1.08	1.17	.09
6	0.00	.10	.75	.14	.19	.16	2.19	.10	.01	1.34	2.30	.96
7	0.00	.81	.75	.14	.19	.16	2.21	.10	.08	2.06	2.39	.33
8	0.00	.95	.67	.17	.14	.15	1.90	.10	.09	2.07	2.10	.03
9	0.00	.95	.67	.17	.14	.15	1.92	.10	.09	2.07	2.11	.05
10	.19	0.00	.67	.17	.14	.15	1.94	.10	0.00	1.31	2.04	.73
11	0.00	.23	.51	.27	.17	.13	1.08	.10	0.00	1.30	1.18	-.12
12	0.00	0.00	.75	.14	.19	.16	2.25	.10	0.00	1.24	2.36	1.11
13	0.00	0.00	.75	.14	.19	.16	2.28	.10	0.00	1.24	2.38	1.13
14	0.00	0.00	.67	.17	.14	.15	1.95	.10	0.00	1.12	2.06	.94
15	0.00	0.00	.67	.17	.14	.15	1.97	.10	0.00	1.12	2.07	.96
16	0.00	.10	.67	.17	.14	.15	1.99	.10	.01	1.22	2.10	.88
17	0.00	0.00	.51	.27	.17	.13	1.09	.10	0.00	1.08	1.19	.11
18	0.00	0.00	.75	.14	.19	.16	2.30	.10	0.00	1.24	2.40	1.16
19	.19	.81	.75	.14	.19	.16	2.32	.10	.10	2.24	2.52	.28
20	0.00	0.00	.67	.17	.14	.15	2.01	.10	0.00	1.12	2.11	.99

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 4.32

Table 1-16

FINANCIAL APPRAISAL OF A 9 ACRE LAND IMPROVEMENT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: NO CHANGE IN LAND USE-
TAME HAY BEFORE AND
AFTER IMPROVEMENT

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODUCTION	HARVEST	LABOR	OTHER	SALES	SUBSIDY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	2.03	1.58	-.45
2	0.00	0.00	.55	.17	.14	.14	1.35	.10	0.00	.99	1.45	.46
3	0.00	0.00	.55	.17	.14	.14	1.38	.10	0.00	.99	1.48	.49
4	0.00	0.00	.55	.17	.14	.14	1.40	.10	0.00	.99	1.51	.51
5	0.00	0.00	.55	.17	.14	.14	1.43	.10	0.00	.99	1.53	.54
6	0.00	.05	.55	.17	.14	.14	1.42	.10	.00	1.04	1.53	.49
7	0.00	.81	.55	.17	.14	.14	1.41	.10	.08	1.81	1.60	-.21
8	0.00	.62	.55	.17	.14	.14	1.40	.10	.06	1.61	1.57	-.04
9	0.00	.62	.55	.17	.14	.14	1.40	.10	.06	1.61	1.56	-.05
10	.19	0.00	.55	.17	.14	.14	1.39	.10	0.00	1.18	1.49	.31
11	0.00	0.00	.55	.17	.14	.14	1.39	.10	0.00	.99	1.48	.49
12	0.00	0.00	.55	.17	.14	.14	1.37	.10	0.00	.99	1.47	.48
13	0.00	0.00	.55	.17	.14	.14	1.36	.10	0.00	.99	1.46	.47
14	0.00	0.00	.55	.17	.14	.14	1.35	.10	0.00	.99	1.45	.46
15	0.00	0.00	.55	.17	.14	.14	1.34	.10	0.00	.99	1.44	.45
16	0.00	.05	.55	.17	.14	.14	1.34	.10	.00	1.04	1.44	.41
17	0.00	0.00	.55	.17	.14	.14	1.33	.10	0.00	.99	1.43	.44
18	0.00	0.00	.55	.17	.14	.14	1.33	.10	0.00	.99	1.43	.44
19	.19	.81	.55	.17	.14	.14	1.32	.10	.08	1.99	1.51	-.49
20	0.00	0.00	.55	.17	.14	.14	1.32	.10	0.00	.99	1.42	.43

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 2.21

Table 1-17

FINANCIAL APPRAISAL OF A 9 ACRE LAND IMPROVEMENT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: ORIGINAL CROP-TAME HAY;AFTER
LAND IMPROVEMENT-WINTER WHEAT, 1YR; BARLEY, 1YR;
GRAIN CORN, 1YR;ROTATION CYCLE REPEATS

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	2.03	1.58	-.45
2	0.00	0.00	.56	.29	.17	.13	2.10	.10	0.00	1.15	2.20	1.05
3	0.00	0.00	.52	.28	.17	.13	1.11	.10	0.00	1.10	1.21	.11
4	0.00	0.00	.75	.43	.15	.15	1.99	.10	0.00	1.47	2.09	.62
5	0.00	0.00	.56	.29	.17	.13	2.13	.10	0.00	1.15	2.23	1.08
6	0.00	.10	.52	.28	.17	.13	1.12	.10	.01	1.20	1.23	.03
7	0.00	.06	.75	.43	.15	.15	2.01	.10	.01	1.53	2.12	.58
8	0.00	.75	.56	.29	.17	.13	2.14	.10	.08	1.90	2.32	.42
9	0.00	.75	.52	.28	.17	.13	1.13	.10	.08	1.86	1.31	-.55
10	.19	0.00	.75	.43	.15	.15	2.03	.10	0.00	1.66	2.13	.47
11	0.00	.45	.56	.29	.17	.13	2.16	.10	0.00	1.60	2.26	.66
12	0.00	0.00	.52	.28	.17	.13	1.14	.10	0.00	1.10	1.25	.14
13	0.00	0.00	.75	.43	.15	.15	2.05	.10	0.00	1.47	2.15	.68
14	0.00	0.00	.56	.29	.17	.13	2.18	.10	0.00	1.15	2.28	1.14
15	0.00	0.00	.52	.28	.17	.13	1.16	.10	0.00	1.10	1.26	.15
16	0.00	.10	.75	.43	.15	.15	2.07	.10	.01	1.57	2.18	.61
17	0.00	0.00	.56	.29	.17	.13	2.20	.10	0.00	1.15	2.30	1.16
18	0.00	0.00	.52	.28	.17	.13	1.17	.10	0.00	1.10	1.27	.16
19	.19	.06	.75	.43	.15	.15	2.09	.10	.01	1.72	2.19	.48
20	0.00	0.00	.56	.29	.17	.13	2.22	.10	0.00	1.15	2.33	1.18

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 3.55

Table 1-18

FINANCIAL APPRAISAL OF A 9 ACRE LAND IMPROVEMENT PROJECT
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: LAND FALLOW BEFORE IMPROVEMENT;
THEN OATS, 2YR; ALFALFA, 3YR; OATS. 1YR;
CORN SILAGE, 2YR;LAST ROTATION CYCLE REPEATS

	COSTS($000)						BENEFITS($000)			TOTALS($000)		
	INVESTMENT		OPERATING COSTS									
YEAR	LAND IMPRO	MACHE EQUIP	PRODU CTION	HARVE ST	LABOR	OTHER	SALES	SUBSI DY	OTHER	COST	BENEFIT	NETFLOW
1	2.03	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	2.03	1.58	-.45
2	0.00	0.00	.51	.27	.17	.13	1.07	.10	0.00	1.08	1.17	.09
3	0.00	0.00	.51	.27	.17	.13	1.08	.10	0.00	1.08	1.18	.10
4	0.00	0.00	.67	.17	.14	.15	1.85	.10	0.00	1.12	1.95	.83
5	0.00	0.00	.67	.17	.14	.15	1.86	.10	0.00	1.12	1.97	.85
6	0.00	.10	.67	.17	.14	.15	1.88	.10	.01	1.22	1.99	.78
7	0.00	.81	.51	.27	.17	.13	1.09	.10	.08	1.89	1.27	-.62
8	0.00	.95	.75	.14	.19	.16	2.19	.10	.09	2.19	2.38	.19
9	0.00	.95	.75	.14	.19	.16	2.21	.10	.09	2.19	2.41	.21
10	.19	0.00	.67	.17	.14	.15	1.90	.10	0.00	1.31	2.00	.70
11	0.00	.23	.67	.17	.14	.15	1.92	.10	0.00	1.34	2.02	.68
12	0.00	0.00	.67	.17	.14	.15	1.94	.10	0.00	1.12	2.04	.92
13	0.00	0.00	.51	.27	.17	.13	1.10	.10	0.00	1.08	1.20	.12
14	0.00	0.00	.75	.14	.19	.16	2.23	.10	0.00	1.24	2.33	1.09
15	0.00	0.00	.75	.14	.19	.16	2.25	.10	0.00	1.24	2.36	1.11
16	0.00	.10	.67	.17	.14	.15	1.95	.10	.01	1.22	2.07	.85
17	0.00	0.00	.67	.17	.14	.15	1.97	.10	0.00	1.12	2.07	.96
18	0.00	0.00	.67	.17	.14	.15	1.99	.10	0.00	1.12	2.09	.97
19	.19	.81	.51	.27	.17	.13	1.11	.10	.08	2.08	1.30	-.78
20	0.00	0.00	.75	.14	.19	.16	2.28	.10	0.00	1.24	2.38	1.13

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 3.11

a) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

b) the fertilizer and limestone subsidy has been removed from the revenue side, for both projects this averages approximately $11.67 per acre;

c) the capital grant for land clearing and improvements has been removed from the revenue side.

The effect of these adjustments is as follows:

A. LAND CLEARING

The net present value is lowered from $5,485 to $1,462.25.[1]

B. LAND IMPROVEMENT

The net present value is increased from $1,340 to $1,420.[2] This result may be a reflection of the labour component.

1.4.5 Sensitivity Analysis

A. LAND CLEARING

The results of the sensitivity analysis are set out in Tables 1-19, 1-20 and 1-21. As indicated, the base case net present value is extremely sensitive to changes in the discount rate and revenue. The base case net present values are somewhat less sensitive to changes in production costs and barely sensitive to changes in machinery and equipment costs.

B. LAND IMPROVEMENT

The results of the sensitivity analysis are set out in Tables 1-22, 1-23, 1-24 and 1-25. As indicated the base case net present values are extremely sensitive to changes in the discount rate and revenue. The base case net present values are somewhat less sensitive to changes in production costs and land improvement costs. Changes in machinery and equipment costs have little effect on the base case net present value.

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1. A weighted average of Rotation 1 and Rotation 2.

2. Calculated by: Rotation 3 - Rotation 2.

Table 1-19

Sensitivity Analysis
Land Clearing
(NPV in '000 $1978)

Rotation 1

Variables		Benefit-Cost Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			(2.97)	(4.21)	(4.78)		
	BCR			.92	.85	.77		
Mach & Equip	NPV	(3.79)	(3.93)	(4.07)	(4.21)	(4.36)	(4.50)	(4.64)
	BCR	.86	.85	.85	.85	.84	.84	.83
Production Costs	NPV	(2.78)	(3.26)	(3.73)	(4.21)	(4.69)	(5.17)	(5.65)
	BCR	.89	.88	.86	.85	.83	.82	.80
Revenue	NPV	(7.64)	(6.50)	(5.36)	(4.21)	(3.07)	(1.93)	(.78)
	BCR	.72	.76	.80	.85	.89	.93	.97

Variables		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			3.08	.94	(.19)		
	BCR			1.08	1.03	.80		
Mach & Equip	NPV	1.37	1.22	3.08	.94	.80	.65	.51
	BCR	1.05	1.04	1.04	1.03	1.03	1.02	1.02
Production Costs	NPV	2.37	1.90	1.42	.94	.46	(.02)	(.49)
	BCR	1.09	1.07	1.05	1.03	1.02	.99	.98
Revenue	NPV	(2.49)	(1.35)	(.20)	.94	2.08	3.23	4.37
	BCR	.91	.95	.99	1.03	1.07	1.12	1.16

Note: Figures in brackets denote negative values.

Table 1-20
Sensitivity Analysis
Land Clearing
(NPV in '000 $1978)

Rotation 2

Cost-Benefit Analysis

Variables		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			7.37	2.09	(.64)		
	BCR			1.17	1.07	.97		
Mach & Equip	NPV	2.60	2.43	2.26	2.09	1.91	1.74	1.57
	BCR	1.08	1.08	1.07	1.07	1.06	1.05	1.05
Production Costs	NPV	3.85	3.26	2.68	2.09	1.50	.91	.32
	BCR	1.13	1.11	1.09	1.07	1.05	1.03	1.01
Revenue	NPV	(2.86)	(1.21)	.44	2.09	3.73	5.38	7.03
	BCR	.91	.96	1.01	1.07	1.12	1.17	1.22

Financial Analysis

Variables		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			13.14	7.00	3.74		
	BCR			1.29	1.22	1.15		
Mach & Equip	NPV	7.51	7.34	7.17	7.00	6.83	6.65	6.48
	BCR	1.24	1.23	1.22	1.22	1.21	1.20	1.20
Production Costs	NPV	8.77	8.18	7.59	7.00	6.41	5.82	5.23
	BCR	1.29	1.26	1.24	1.22	1.20	1.17	1.15
Revenue	NPV	2.05	3.70	5.35	7.00	8.65	10.29	11.94
	BCR	1.06	1.12	1.17	1.22	1.27	1.32	1.37

Note: Figures in brackets denote negative values.

Table 1-21

Sensitivity Analysis
Land Clearing
(NPV in '000 $1978)

Rotation 3

Variables		Benefit-Cost Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			3.45	(.51)	(2.52)		
	BCR			1.08	.98	.90		
Mach & Equip	NPV	(.19)	(.30)	(.40)	(.51)	(.61)	(.72)	(.82)
	BCR	.99	.99	.99	.98	.98	.98	.97
Production Costs	NPV	1.15	.60	.05	(.51)	(1.06)	(1.61)	(2.17)
	BCR	1.04	1.02	1.00	.98	.97	.95	.94
Revenue	NPV	(5.21)	(3.64)	(2.07)	(.51)	1.06	2.63	4.19
	BCR	.84	.89	.94	.98	1.03	1.08	1.13

Variables		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			9.17	4.36	1.83		
	BCR			1.20	1.13	1.07		
Mach & Equip	NPV	4.68	4.57	4.47	4.36	4.26	4.15	4.05
	BCR	1.14	1.14	1.14	1.13	1.13	1.12	1.12
Production Costs	NPV	6.02	5.47	4.92	4.36	3.81	3.25	2.70
	BCR	1.19	1.17	1.15	1.13	1.11	1.10	1.08
Revenue	NPV	(.34)	1.23	2.80	4.36	5.93	7.49	9.06
	BCR	.99	1.04	1.08	1.13	1.18	1.23	1.28

Note: Figures in brackets denote negative values.

Table 1-22

Sensitivity Analysis
Land Improvement
(NPV in '000 $1978)

Rotation 1

Variables		Benefit-Cost Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			4.60	2.46	1.32		
	BCR			1.27	1.21	1.15		
Land Improvement Costs	NPV	2.75	2.66	2.56	2.46	2.36	2.27	2.17
	BCR	1.24	1.23	1.22	1.21	1.20	1.19	1.18
Mach and Equip	NPV	2.69	2.62	2.54	2.46	2.38	2.31	2.23
	BCR	1.23	1.22	1.22	1.21	1.20	1.19	1.18
Production Costs	NPV	3.22	2.97	2.71	2.46	2.21	1.96	1.70
	BCR	1.29	1.26	1.23	1.21	1.18	1.16	1.14
Revenue	NPV	.34	1.05	1.75	2.46	3.17	3.88	4.59
	BCR	1.03	1.09	1.15	1.21	1.27	1.33	1.39

Variables		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			6.79	4.32	2.97		
	BCR			1.38	1.35	1.33		
Land Improvement Costs	NPV	4.61	4.51	4.42	4.32	4.22	4.13	4.03
	BCR	1.39	1.38	1.36	1.35	1.34	1.33	1.32
Mach and Equip	NPV	4.55	4.47	4.40	4.32	4.24	4.16	4.09
	BCR	1.38	1.37	1.36	1.35	1.34	1.34	1.33
Production Costs	NPV	5.08	4.82	4.57	4.32	4.07	3.81	3.56
	BCR	1.44	1.41	1.38	1.35	1.33	1.30	1.27
Revenue	NPV	2.20	2.90	3.61	4.32	5.03	5.74	6.44
	BCR	1.18	1.24	1.30	1.35	1.41	1.47	1.53

Table 1-23

Sensitivity Analysis
Land Improvement
(NPV in '000 $1978)

Rotation 2

Variables		Benefit-Cost Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			1.13	.30	(.16)		
	BCR			1.08	1.03	.98		
Land Improvement Costs	NPV	.59	.50	.40	.30	.21	.11	.01
	BCR	1.06	1.05	1.04	1.03	1.02	1.01	1.00
Mach and Equip	NPV	.47	.42	.36	.30	.25	.9	.13
	BCR	1.05	1.04	1.04	1.03	1.02	1.02	1.01
Production Costs	NPV	.93	.72	.51	.30	.10	(.11)	(.32)
	BCR	1.10	1.07	1.05	1.03	1.01	.99	.97
Revenue	NPV	(1.27)	(.75)	(.22)	.30	.83	1.35	1.88
	BCR	.88	.93	.98	1.03	1.08	1.13	1.18

Variables		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			3.39	2.21	1.53		
	BCR			1.22	1.21	1.19		
Land Improvement Costs	NPV	2.50	2.40	2.30	2.21	2.11	2.01	1.91
	BCR	1.24	1.23	1.22	1.21	1.20	2.18	1.12
Mach and Equip	NPV	2.30	2.32	2.26	2.21	2.15	2.09	2.03
	BCR	1.23	1.22	1.21	1.21	1.20	1.19	1.19
Production Costs	NPV	2.83	2.62	2.41	2.21	2.00	1.79	1.50
	BCR	1.28	1.26	1.23	1.21	1.18	1.16	1.14
Reveneu	NPV	.63	1.16	1.68	2.21	2.73	3.26	3.78
	BCR	1.06	1.11	1.15	1.21	1.26	1.31	1.36

Note: Figures in brackets denote negative values.

Table 1-24

Sensitivity Analysis
Land Improvement
(NPV in '000 $1978)

Rotation 3

Variables		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
		Benefit-Cost Analysis						
Discount Rate	NPV			3.43	1.72	.82		
	BCR			1.20	1.14	1.09		
Land Improvement Costs	NPV	2.01	1.91	1.82	1.72	1.62	1.52	1.43
	BCR	1.17	1.16	1.15	1.14	1.14	1.13	1.12
Mach and Equip	NPV	1.86	1.81	1.77	1.72	1.67	1.62	1.58
	BCR	1.16	1.15	1.15	1.14	1.14	1.14	1.13
Production Costs	NPV	2.41	2.18	1.95	1.72	1.49	1.26	1.03
	BCR	1.22	1.19	1.17	1.14	1.12	1.10	1.08
Revenue	NPV	(.31)	.37	1.04	1.72	2.39	3.07	3.74
	BCR	.97	1.03	1.09	1.14	1.20	1.26	1.32

Variables		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
		Financial Analysis						
Discount Rate	NPV			5.59	3.55	2.45		
	BCR			1.31	1.29	1.27		
Land Improvement Costs	NPV	3.84	3.75	3.65	3.55	3.45	3.36	3.26
	BCR	1.32	1.31	1.30	1.29	1.28	1.27	1.26
Mach and Equip	NPV	3.69	3.65	3.60	3.55	3.50	3.46	3.41
	BCR	1.30	1.30	1.30	1.29	1.28	1.28	1.28
Production Costs	NPV	4.24	4.01	3.78	3.55	3.32	3.09	2.87
	BCR	1.12	1.18	1.24	1.29	1.34	1.40	1.46
Revenue	NPV	1.53	2.20	2.88	3.55	4.23	4.90	5.50
	BCR	1.12	1.18	.24	1.29	1.34	1.40	1.46

Note: Figures in brackets denote negative values.

Table 1-25

Sensitivity Analysis
Land Improvement
(NPV in '000 $1978)

Rotation 4

Variables		Benefit-Cost Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV BCR			3.12 1.18	1.26 1.11	.29 1.03		
Land Improve-ment Cost	NPV BCR	1.56 1.14	1.46 1.13	1.36 1.12	1.26 1.11	1.17 1.10	1.07 1.09	.97 1.08
Mach and Equip	NPV BCR	1.50 1.13	1.42 1.12	1.34 1.12	1.26 1.11	1.19 1.10	1.11 1.09	1.03 1.08
Production Costs	NPV BCR	1.98 1.18	1.74 1.15	1.50 1.13	1.26 1.11	1.02 1.08	.78 1.06	.55 1.04
Revenue	NPV BCR	(.66) .94	(.02) .99	.62 1.05	1.26 1.11	1.91 1.16	2.55 1.22	3.19 1.27

Variables		Financial Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV BCR			5.31 1.30	3.11 1.26	1.94 1.22		
Land Improve-ment Cost	NPV BCR	3.40 1.29	3.33 1.28	3.21 1.27	3.11 1.26	3.01 1.25	2.92 1.24	2.82 1.23
Mach and Equip	NPV BCR	3.34 1.28	3.27 1.27	3.19 1.26	3.11 1.26	3.03 1.25	2.96 1.24	2.82 1.23
Production Costs	NPV BCR	3.83 1.34	3.59 1.31	3.35 1.28	3.11 1.26	2.87 1.23	2.63 1.21	2.39 1.19
Revenue	NPV BCR	1.18 1.10	1.83 1.15	2.47 1.20	3.11 1.26	3.75 1.31	4.40 1.36	5.04 1.42

Note: Figures in brackets denote negative values.

II. HIGH ENERGY AND PROTEIN FEED PRODUCTION AND DEVELOPMENT PROGRAMME

2.0 High Energy and Protein Crop Incentive

2.1 Sector Profile

Production of grains in Nova Scotia has been variable over the past twenty-five years. There have been significant increases in output of wheat and barley as indicated in Table 2-1, and a slight decrease in the production of mixed grains. The increases have been more than offset by a substantial reduction in the production of oats resulting in an overall decline in total grain production. This pattern of production has been attributable to a number of factors, the most important of which are changes in relative grain prices, relative price increases of crops competing for limited acreage and increased competition from imported grains.

Demand for domestic and imported grains in Nova Scotia is almost exclusively for use as livestock feed. Over 90 percent of grains produced locally are used as feed. As indicated in Column 1 of Table 2-2, total demand for feed grain has increased by some 14 percent over the past 25 years, rising from 172,500 tonnes in 1951 to 195,700 tonnes in 1976. Over this period the proportion of total demand accounted for by local production declined from 30 percent to 16 percent. The increasing relative importance of imports is accounted for chiefly by relative price changes in which the use of grain corn and screenings have increased at the expense of wheat and oats (the scope for substitution of local for imported grain corn is limited due to climatic conditions in Nova Scotia). Growth in the production of local wheat (Table 2-1) has not been great enough to offset the decline in wheat imports.

The decrease in protein feed production has occurred over a period of expansion in the livestock industry. This increased dependence on imports had led to the identification of opportunities for expanded local production.

Table 2-1

Acreage and Production of Principal Grains 1951 - 1976

	Wheat		Oats		Barley		Mixed	
	Acres	Production (tonnes)	Acres	Production (tonnes)	Acres	Production (tonnes)	Acres	Production (tonnes)
1976	3,800	4,408	18,900	15,453	4,500	4,790	5,800	8,260
1971	4,900	5,089	17,800	11,397	8,700	7,119	8,500	9,296
1966	1,400	1,469	25,700	22,516	3,600	3,962	10,100	14,554
1961	1,400	1,143	37,500	24,351	1,100	893	8,500	9,068
1956	800	544	43,300	31,384	1,500	1,219	9,700	11,836
1951	1,200	708	61,600	40,853	4,400	3,069	8,800	8,940

Source: Province of Nova Scotia, *Agricultural Statistics 1978*, Tables 36, 37, 38, 39.

Table 2-2

Nova Scotia Feed Grain Demand
1951 - 1976

	Total Demand '000 tonnes	Imports '000 tonnes	Imports %	Production '000 tonnes	Production %
	1	2	3	4	5
1976	195.7	164.4	84	31.3	16
1971	205.7	174.4	85	31.3	15
1966	175.4	135.0	77	40.4	23
1961	146.4	112.7	77	33.7	23
1956	162.7	120.0	74	42.7	26
1951	172.5	121.6	70	50.9	30

Source: Province of Nova Scotia, Agricultural Statistics 1978, Table 64 and from Table 2-1, on preceding page.

2.2 Project Description

2.2.1 Objectives

The High Energy and Protein Crop Incentive Programme is linked directly to programmes designed to expand the agricultural land base and, as well, the livestock numbers in the Province. The Province has underutilized land resources, as indicated in Schedule "A" of the Subsidiary Agreement. This Programme provides an opportunity for farmers to utilize this land and at the same time reduce purchased feed inputs. The primary objective of this programme is:

- to promote increased production of high energy and protein crops

A target of 36,000 additional acres of grain production is stated.

To qualify for assistance under the Programme the grain grower must:

- bring land into grain production which was additional to the average annual feed grain acreage in production on the farm during the three years 1973, 1974 and 1975, or the acreage in production during 1976, whichever was the greater.

Assistance is provided on the basis of loans of $75.00 per acre for each acre of additional land brought into feed grain production. Grains for which a loan applies include wheat, oats, barley, corn, rye, fababeans, soybeans, field peas and rapeseed. The minimum loan is $750.00 to one grower in any one year, the maximum is $15,000 to one grower during the length of the Programme. These loans are repayable over a period of five years. A forgiveness grant of interest plus $15.00 on the loan principle will be made for .9072 tonnes (1 ton) of grain produced per acre of land for which the loan was granted and consigned for sale or use on the farm. Participants will be monitored to determine whether the forgiveness grant applies.

The estimated five year cost of the Programme was $2.75 million to be divided as follows:

Federal Share	Provincial Share
$2,200,000	$550,000

2.2.2 Project Performance

A summary of expenditures, acres brought into production, and types of crops planted over the first four years of the Programme is presented in Table 2-3. After four years into the Programme there were 221 loans granted for a total expenditure of $725,900. This expenditure amounted to a total of 9,678 additional acres of grain production. It is interesting to note that of the 221 participants for whom loans were granted as many as 20 percent may have been repeat participants.

As Table 2-3 indicates 9,678 acres of additional acres have been brought into production. After four years this represents a 27 percent achievement of the stated five year target of 36,000 additional acres of grain production. It appears as though the Programme will fall well short of its five year objective. Relative prices of imported grains may account for a large part of this.

Table 2-3

High Energy and Protein Crop Incentive Programme

	1976	1977	1978	1979	Totals	% of Total
a) Number of Farms	47	63	43	68	221	
b) Grain increases (acres)						
i) winter wheat	511	540	349	735	2,135	22.1
ii) spring wheat	253	250	21	61	585	6.0
iii) oats	393	668	340	498	1,899	19.6
iv) barley	307	313	420	413	1,453	15.0
v) mixed grain	225	149	168	231	773	8.0
vi) grain corn	259	573	391	350	1,573	16.25
vii) other	271	39	221	729	1,260	13.0
TOTAL ACRES	2,219	2,532	1,910	3,017	9,678	100
c) Loans granted ($'000)	166.4	189.9	143.3	226.3	725.9	

Source: Annual Reports.

2.2.3 Participant Profile

A profile of the average participant based on information contained in the Survey is presented in Table 2-4. This information covers the first three years of the Programme and is based on a sample of 33 producers, approximately 22 percent of total participants (153) up to that point. The information presented here provides a rough indication only of the average operation. For a more detailed description of participants see Sorflaten 1980.

The most significant points to note about the average participant in the High Energy and Protein Crop Programme are as follows:

a) the farm employed 1.93 persons;

b) off-farm work was low;

c) 43.7 percent of participants marketed their grain as a cash crop, the remaining 56.4 percent marketed their grain as livestock feed;

d) majority of new grain land was used for tame hay before Programme (42 percent);

e) 51.5 percent of participants leased land for incentive;

f) approximately 44 acres of new grain land brought into production by participants;

g) participation was dominated by those with sales below $24,999 (36.3 percent) and those above $75,000 (45.4 percent);

h) participants were primarily beef (12), dairy (11) and hogs (12);

i) 27.3 percent of the 33 producers who responded to this question indicated they would have undertaken the project without assistance.

Table 2-4

Profile of Average Participant
High Energy and Protein Crop Incentive Programme

	Number of Responses	Average Measure	Average Percentage
1. Age of operator	33	43.03 years	
2. Type of farm: family	28		
partnership	4		
3. Total land area operated	33	539.88 acres	
4. Value of machinery and equipment	33	$292,895.45	
5. Value of machinery and equipment	33	$68,108.21	
6. Total cattle and calves	23	99.26 head	
7. Cows and heifers for milking	11	57.45 head	
8. Total pigs	12	540.5 head	
9. Sows for breeding purposes	7	95 head	
10. Total sheep and lambs	2	42 head	
11. Total chickens	5	24,920 birds	
12. Labour: Employees	14	1.93 persons	
Weeks paid labour - male	27	54 weeks	
female	3	22 weeks	
13. Off-farm work	10	161.9 days	
14. Value of products sold			
0 - 24,999	12		36.3
25,000 - 49,999	1		3
50,000 - 74,999	5		15.2
75,000 and over	15		45.4

2.3 Methodology

2.3.1 Methodological Issues

In general, the method used in the Cost-Benefit Analysis of the Crop Incentive Programme adheres to the conventional approach outlined in Chapter Two. There are slight deviations from this approach, however, in that there are four cases built around a single cropping rotation. These cases are:

i) output valued as feed replacement, with a completely forgiven loan;

ii) output valued as feed replacement, with a partially forgiven loan (i.e. 25 percent of acreage does not meet forgiveness criteria in years 1-5);

iii) output valued as a cash crop, with a completely forgiven loan;

iv) output valued as a cash crop, with a partially forgiven loan (i.e. 25 percent of acreage does not meet forgiveness criteria in years 1-5).

The method of evaluation, in effect, remains the same, but a variety of alternatives are presented in order to cover a wide range of situations.

Incremental capital and operating costs and revenues were estimated using historical data and by simulating the production of 44 additional acres of grain land on a farm unit over the twenty year evaluation period. The results of this analysis were generalized to all participating producers and an adjustment made for incrementality in order to assess the performance of the overall programme.

2.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis:

a) Unit Size: all cost and benefit estimates are based on 44 additional acres of land brought into grain production. This figure represents the average acreage per applicant over the first four years of the Programme.

b) Base Year: all cost and benefit projections are expressed in 1978 constant dollars.

c) Crop Rotation: the crop rotation chosen was comprised of grains eligible for the incentive. Further, the rotation was designed in an agronomically sound fashion in that a nitrogen fixer is incorporated. The rotation used over the twenty year evalaution period follows:

oats	1 year
grain corn	1 year
faba beans	1 year
winter wheat	1 year

- this cycle repeats with barley being substituted for oats in alternate plantings.

d) Investment Costs:

i) Machinery and Equipment: requirements for, and costs of machinery and equipment were derived from the 1978 Farm Management Advisory Manual. It was assumed that all machinery was at its half-life in year 1 of the evaluation. Machinery and equipment costs were allocated on a proportional basis to the number of additional acres brought into grain production. In the case of 44 acres of additional grain production, machinery and equipment costs are allocated at 22 percent based on 200 acres being farmed.

e) Operating Costs:

i) production: production costs were derived from the 1978 Farm Management Advisory Manual.

ii) harvest: harvest costs were derived from the 1978 Farm Management Advisory Manual.

iii) labour: labour costs were derived from the production and harvest costs and separated from them. Labour was valued at $3.50 per hour.

iv) other: other costs include machinery repair and insurance expenses. These costs were calculated according to the methodology presented in the Farm Management crop sheets.

f) Benefits:

i) Sales: sales were valued two ways, namely as feed replacement and as a cash crop. The difference between the two values being attributed to transportation and milling costs. Output valued as feed replacement reflects the extra charges. A $12.00 per tonne difference was assumed. Yield/acre and value/tonne are listed for the crops in the rotation as follows:

	Yield/Acre (tonnes)	Value/Tonne ($ 1978) Feed Replacement	Cash Crop
oats	.9	131.54	119.54
grain corn	1.5	147.17	135.17
faba beans	1.15	188.56	176.56
winter wheat	1.5	155.39	143.39
barley	1.0	123.45	111.45

The output was valued in two different ways because Survey data indicated that 56.3 percent of sample farms valued their crop as a feed replacement and the remaining 43.7 percent valued their output as a cash crop. As in the case of Land Development crop yields were increased over time.

ii) other: other benefits were the salvage value received for expended machinery and equipment. A salvage value of 10 percent of the cost of replacement was assumed.

iii) subsidy: the subsidy was paid on the basis of $75 per acre of additional land brought into grain production. For 44 acres this amounted to $3300 in year 1. If forgiveness conditions were met completely; the loan became an outright grant. In this exercise a case was examined where 25 percent of the acreage was subject to a $20 penalty per acre. This forgiveness penalty applied only to years 1-5.

iv) opportunity costs: from the Survey it was determined that the majority of the grain acreage brought into production had previously been growing grass hay. The opportunity cost was derived from the benefits (net of costs) received from growing tame hay on the 44 acres. In years 7, 8, 9 and 19 the opportunity cost appears as a positive because it reflects the additional capital requirements of the production and harvesting of grass hay. That is to say, there exists a saving in machinery and equipment costs of growing grain instead of hay.

2.4 Results

2.4.1 Cost-Benefit Analysis

The analysis of the High Energy and Protein Crop Incentive is based on four cases:

i) output valued as feed replacement, completely forgiven loan;

ii) output valued as feed replacement, partially forgiven loan;

iii) output valued as cash crop, completely forgiven loan;

iv) output valued as cash crop, partially forgiven loan.

The costs and benefits of these base cases (44 acres of grain planted) are set out in cash flow form in Tables 2-5 to 2-8. The analyses indicate that the project will yield the following results:

i)	Net Present Value	$5,930
	Benefit-Cost Ratio	1.10
ii)	Net Present Value	$5,850
	Benefit-Cost Ratio	1.10
iii)	Net Present Value	$ 620
	Benefit-Cost Ratio	1.01
iv)	Net Present Value	$ 620
	Benefit-Cost Ratio	1.01

These base case results are for the single producer putting 44 additional acres of land into grain production. We estimate that over the first four years of the programme 220 of these 44 acre units have been brought into production. In order to calculate the net present value for the programme as a whole it is necessary to obtain some weighted average of the above four cases. Survey data provides the necessary information to do so.

i.e. 43.7 percent of output sold as a cash crop
56.7 percent of output valued as feed replacement

Table 2-5

ECONOMIC APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS FEED REPLACEMENT.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR.,
FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- NO REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.51	.70	5.21	0.00	0.00	-1.76	5.00	3.45	-1.55
2	0.00	3.65	2.08	.43	.74	9.71	0.00	0.00	-1.76	6.89	7.96	1.06
3	0.00	4.75	1.53	.51	.82	9.54	0.00	0.00	-1.76	7.61	7.79	.18
4	0.00	2.73	1.39	.51	.71	10.26	0.00	0.00	-1.76	5.34	8.50	3.16
5	0.00	2.55	1.36	.51	.70	5.43	0.00	0.00	-1.76	5.12	3.68	-1.44
6	.49	3.65	2.08	.43	.74	9.81	.05	0.00	-1.56	7.38	8.30	.92
7	.30	4.75	1.53	.51	.82	9.62	.03	0.00	1.82	7.90	11.48	3.57
8	3.68	2.73	1.39	.51	.71	10.36	.37	0.00	.96	9.02	11.59	2.67
9	3.68	2.47	1.32	.59	.70	5.27	.37	0.00	.96	8.77	6.60	-2.17
10	0.00	3.65	2.08	.54	.74	9.91	0.00	0.00	-1.76	7.00	8.15	1.15
11	2.20	4.75	1.53	.68	.82	9.71	0.00	0.00	-1.76	9.98	7.95	-2.02
12	0.00	2.73	1.39	.72	.71	10.46	0.00	0.00	-1.76	5.55	8.71	3.15
13	0.00	2.55	1.36	.76	.70	5.69	0.00	0.00	-1.76	5.38	3.93	-1.44
14	0.00	3.65	2.08	.65	.74	10.00	0.00	0.00	-1.76	7.11	8.25	1.14
15	0.00	4.75	1.53	.76	.82	9.79	0.00	0.00	-1.76	7.86	8.04	.17
16	.49	2.73	1.39	.76	.71	10.56	.05	0.00	-1.56	6.08	9.06	2.97
17	0.00	2.47	1.32	.76	.70	5.32	0.00	0.00	-1.76	5.26	3.57	-1.69
18	0.00	3.65	2.08	.65	.74	10.70	0.00	0.00	-1.76	7.11	8.95	1.84
19	.30	4.75	1.53	.76	.82	9.87	.03	0.00	1.82	9.16	11.73	3.57
20	0.00	2.73	1.39	.76	.71	10.67	0.00	0.00	-1.76	5.59	8.91	3.32

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 5.93

Table 2-6

ECONOMIC APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS FEED REPLACEMENT.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR.
FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- 25% REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.51	.70	5.21	0.00	0.00	-1.76	5.00	3.45	-1.55
2	0.00	3.65	2.08	.43	.74	9.71	0.00	0.00	-1.76	6.89	7.96	1.06
3	0.00	4.75	1.53	.51	.82	9.54	0.00	0.00	-1.76	7.61	7.79	.18
4	0.00	2.73	1.39	.51	.71	10.26	0.00	0.00	-1.76	5.34	8.50	3.16
5	0.00	2.55	1.36	.51	.70	5.43	0.00	0.00	-1.76	5.12	3.68	-1.44
6	.49	3.65	2.08	.43	.74	9.81	.05	0.00	-1.56	7.39	8.30	.92
7	.30	4.75	1.53	.51	.82	9.62	.03	0.00	1.82	7.90	11.48	3.57
8	3.68	2.73	1.39	.51	.71	10.36	.37	0.00	.96	9.02	11.69	2.67
9	3.68	2.47	1.32	.59	.70	5.27	.37	0.00	.96	8.77	6.60	-2.17
10	0.00	3.65	2.08	.54	.74	9.91	0.00	0.00	-1.76	7.00	8.15	1.15
11	2.20	4.75	1.53	.68	.82	9.71	0.00	0.00	-1.76	9.98	7.95	-2.02
12	0.00	2.73	1.39	.72	.71	10.46	0.00	0.00	-1.76	5.55	8.71	3.15
13	0.00	2.55	1.36	.76	.70	5.69	0.00	0.00	-1.76	5.38	3.93	-1.44
14	0.00	3.65	2.08	.65	.74	10.00	0.00	0.00	-1.76	7.11	8.25	1.14
15	0.00	4.75	1.53	.76	.82	9.79	0.00	0.00	-1.76	7.86	8.04	.17
16	.49	2.73	1.39	.76	.71	10.56	.05	0.00	-1.76	6.08	8.96	2.77
17	0.00	2.47	1.32	.76	.70	5.32	0.00	0.00	-1.76	5.26	3.57	-1.69
18	0.00	3.65	2.08	.65	.74	10.70	0.00	0.00	-1.76	7.11	8.95	1.84
19	.30	4.75	1.53	.76	.82	9.87	.03	0.00	1.60	8.16	11.51	3.35
20	0.00	2.73	1.39	.76	.71	10.67	0.00	0.00	-1.76	5.59	8.91	3.32

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 5.85

Table 2-7

ECONOMIC APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS CASH CROP.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR, FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- NO REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.51	.70	4.42	0.00	0.00	-1.76	5.00	2.66	-2.34
2	0.00	3.65	2.08	.43	.74	8.92	0.00	0.00	-1.76	6.89	7.17	.27
3	0.00	4.75	1.53	.51	.82	9.54	0.00	0.00	-1.76	7.61	7.79	.18
4	0.00	2.73	1.39	.51	.71	9.46	0.00	0.00	-1.76	5.34	7.71	2.37
5	0.00	2.55	1.36	.51	.70	4.64	0.00	0.00	-1.76	5.12	2.89	-2.24
6	.49	3.65	2.08	.43	.74	9.02	.05	0.00	-1.56	7.38	7.51	.13
7	.30	4.75	1.53	.51	.82	9.62	.03	0.00	1.82	7.90	11.48	3.57
8	3.68	2.73	1.39	.51	.71	9.57	.37	0.00	.96	9.02	10.90	1.88
9	3.68	2.47	1.32	.59	.70	4.47	.37	0.00	.96	8.77	5.81	-2.96
10	0.00	3.65	2.08	.54	.74	9.12	0.00	0.00	-1.76	7.00	7.36	.36
11	2.20	4.75	1.53	.68	.82	9.71	0.00	0.00	-1.76	9.98	7.95	-2.02
12	0.00	2.73	1.39	.72	.71	9.67	0.00	0.00	-1.76	5.55	7.91	2.36
13	0.00	2.55	1.36	.76	.70	4.69	0.00	0.00	-1.76	5.38	2.94	-2.44
14	0.00	3.65	2.08	.65	.74	9.21	0.00	0.00	-1.76	7.11	7.46	.35
15	0.00	4.75	1.53	.76	.82	9.79	0.00	0.00	-1.76	7.86	8.04	.17
16	.49	2.73	1.39	.76	.71	9.77	.05	0.00	-1.56	6.08	8.26	2.18
17	0.00	2.47	1.32	.76	.70	4.53	0.00	0.00	-1.76	5.26	2.78	-2.48
18	0.00	3.65	2.08	.65	.74	9.31	0.00	0.00	-1.76	7.11	7.55	.44
19	.30	4.75	1.53	.76	.82	9.87	.03	0.00	1.82	8.16	11.73	3.57
20	0.00	2.73	1.39	.76	.71	9.87	0.00	0.00	-1.76	5.59	8.12	2.53

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= .62

Table 2-8

ECONOMIC APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS CASH CROP.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR.
FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- 25% REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.51	.70	4.42	0.00	0.00	-1.76	5.00	2.66	-2.34
2	0.00	3.65	2.08	.43	.74	8.92	0.00	0.00	-1.76	6.89	7.17	.27
3	0.00	4.75	1.53	.51	.82	9.54	0.00	0.00	-1.76	7.61	7.79	.18
4	0.00	2.73	1.39	.51	.71	9.46	0.00	0.00	-1.76	5.34	7.71	2.37
5	0.00	2.55	1.36	.51	.70	4.64	0.00	0.00	-1.76	5.12	2.89	-2.24
6	.49	3.65	2.08	.43	.74	9.02	.05	0.00	-1.56	7.38	7.51	.13
7	.30	4.75	1.53	.51	.82	9.62	.03	0.00	1.82	7.90	11.48	3.57
8	3.68	2.73	1.39	.51	.71	9.57	.37	0.00	.96	9.02	10.90	1.88
9	3.68	2.47	1.32	.59	.70	4.47	.37	0.00	.96	8.77	5.81	-2.96
10	0.00	3.65	2.08	.54	.74	9.12	0.00	0.00	-1.76	7.00	7.36	.36
11	2.20	4.75	1.53	.68	.82	9.71	0.00	0.00	-1.76	9.98	7.95	-2.02
12	0.00	2.73	1.39	.72	.71	9.67	0.00	0.00	-1.76	5.55	7.91	2.36
13	0.00	2.55	1.36	.76	.70	4.69	0.00	0.00	-1.76	5.38	2.94	-2.44
14	0.00	3.65	2.08	.65	.74	9.21	0.00	0.00	-1.76	7.11	7.46	.35
15	0.00	4.75	1.53	.76	.82	9.79	0.00	0.00	-1.76	7.86	8.04	.17
16	.49	2.73	1.39	.76	.71	9.77	.05	0.00	-1.56	6.08	8.26	2.18
17	0.00	2.47	1.32	.76	.70	4.53	0.00	0.00	-1.76	5.26	2.78	-2.48
18	0.00	3.65	2.08	.65	.74	9.31	0.00	0.00	-1.76	7.11	7.55	.44
19	.30	4.75	1.53	.76	.82	9.87	.03	0.00	1.82	8.16	11.73	3.57
20	0.00	2.73	1.39	.76	.71	9.87	0.00	0.00	-1.76	5.59	8.12	2.53

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= .62

Further, in the analysis an assumption was made that in the case of partial repayment of the loan, 25 percent of the acreage was affected. This is an overstatement, but it should not affect the final weighted average unduly. The programme as a whole will, accordingly, yield the following results:

.564 [.75 (\$5,930) + .25 (\$5,850)] + .437 [.75 (\$620) + .25 (\$620)]
= .564 (\$5,910) + .437 (\$620)
= \$3,333.24 + \$270.94
= \$3,604.18 x 220 = <u>\$792,919.60</u>

<u>Net Present Value</u> - \$792,919.60

The results indicate that from the perspective of society as a whole, the programme to date has been worthwhile.

2.4.2 <u>Incrementality</u>

The gross net present value of \$792,919.60 cannot be attributed exclusively to incentives provided under the programme. The Survey indicates that 27 percent of those participating would have undertaken the work without assistance. The implication of this finding is that the programme in fact contributed directly to the initiation of 161 of these 44 acre units. These would generate a NPV of \$580,272.98.

2.4.3 <u>Financial Analysis</u>

The financial analysis has been undertaken from the perspective of the private producer who actually makes the investment. The results using this approach are set out in Tables 2-9 to 2-12. In summary form, the base case net present values are as follows:

i)	Net Present Value	\$11,290
ii)	Net Present Value	\$10,380
iii)	Net Present Value	\$ 5,980
iv)	Net Present Value	\$ 5,150

Table 2-9

FINANCIAL APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS FEED REPLACEMENT.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR,
FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- NO REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.85	.70	5.21	0.00	3.83	-1.76	5.34	7.28	1.95
2	0.00	3.65	2.08	.72	.74	9.71	0.00	.53	-1.76	7.18	8.49	1.31
3	0.00	4.75	1.53	.85	.82	9.54	0.00	.53	-1.76	7.95	8.32	.37
4	0.00	2.73	1.39	.85	.71	10.26	0.00	.53	-1.76	5.68	9.03	3.35
5	0.00	2.55	1.36	.85	.70	5.43	0.00	.53	-1.76	5.46	4.21	-1.25
6	.49	3.65	2.08	.72	.74	9.81	.05	.53	-1.56	7.67	8.83	1.16
7	.30	4.75	1.53	.85	.82	9.62	.03	.53	1.82	8.24	12.01	3.77
8	3.68	2.73	1.39	.85	.71	10.36	.37	.53	.96	9.36	12.22	2.86
9	3.68	2.47	1.32	.85	.70	5.27	.37	.53	.96	9.02	7.13	-1.89
10	0.00	3.65	2.08	.72	.74	9.91	0.00	.53	-1.76	7.18	8.68	1.50
11	2.20	4.75	1.53	.85	.82	9.71	0.00	.53	-1.76	10.15	8.48	-1.66
12	0.00	2.73	1.39	.85	.71	10.46	0.00	.53	-1.76	5.68	9.24	3.56
13	0.00	2.55	1.36	.85	.70	5.69	0.00	.53	-1.76	5.46	4.46	-1.00
14	0.00	3.65	2.08	.72	.74	10.00	0.00	.53	-1.76	7.18	8.78	1.60
15	0.00	4.75	1.53	.85	.82	9.79	0.00	.53	-1.76	7.95	8.57	.62
16	.49	2.73	1.39	.85	.71	10.56	.05	.53	-1.56	6.17	9.59	3.42
17	0.00	2.47	1.32	.85	.70	5.32	0.00	.53	-1.76	5.34	4.10	-1.25
18	0.00	3.65	2.08	.72	.74	10.70	0.00	.53	-1.76	7.18	9.48	2.29
19	.30	4.75	1.53	.85	.82	9.87	.03	.53	1.82	8.24	12.26	4.01
20	0.00	2.73	1.39	.85	.71	10.67	0.00	.53	-1.76	5.68	9.44	3.76

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 11.29

Table 2-10

FINANCIAL APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS FEED REPLACEMENT.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR, FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- 25% REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.85	.70	5.21	0.00	3.61	-1.76	5.34	7.06	1.73
2	0.00	3.65	2.08	.72	.74	9.71	0.00	.31	-1.76	7.18	8.27	1.09
3	0.00	4.75	1.53	.85	.82	9.54	0.00	.31	-1.76	7.95	8.10	.15
4	0.00	2.73	1.39	.85	.71	10.26	0.00	.31	-1.76	5.68	8.81	3.13
5	0.00	2.55	1.36	.85	.70	5.43	0.00	.31	-1.76	5.46	3.99	-1.47
6	.49	3.65	2.08	.72	.74	9.81	.05	.53	-1.56	7.67	8.83	1.16
7	.30	4.75	1.53	.85	.82	9.62	.03	.53	1.82	8.24	12.01	3.77
8	3.68	2.73	1.39	.85	.71	10.36	.37	.53	.96	9.36	12.22	2.86
9	3.68	2.47	1.32	.85	.70	5.27	.37	.53	.96	9.02	7.13	-1.89
10	0.00	3.65	2.08	.72	.74	9.01	0.00	.53	-1.76	7.18	8.68	1.50
11	2.20	4.75	1.53	.85	.82	9.71	0.00	.53	-1.76	10.15	8.48	-1.66
12	0.00	2.73	1.39	.85	.71	10.46	0.00	.53	-1.76	5.68	9.24	3.56
13	0.00	2.55	1.36	.85	.70	5.69	0.00	.53	-1.76	5.46	4.46	-1.00
14	0.00	3.65	2.08	.72	.74	10.00	0.00	.53	-1.76	7.18	8.78	1.60
15	0.00	4.75	1.53	.85	.82	9.79	0.00	.53	-1.76	7.95	8.57	.62
16	.49	2.73	1.39	.85	.71	10.56	.05	.53	-1.76	6.17	9.39	3.22
17	0.00	2.47	1.32	.85	.70	5.32	0.00	.53	-1.76	5.34	4.10	-1.25
18	0.00	3.65	2.08	.72	.74	10.70	0.00	.53	-1.76	7.18	9.48	2.29
19	.30	4.75	1.53	.85	.82	9.87	.03	.53	1.60	8.24	12.04	3.79
20	0.00	2.73	1.39	.85	.71	10.67	0.00	.53	-1.76	5.68	9.44	3.76

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 10.38

Table 2-11

FINANCIAL APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS CASH CROP.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR, FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- NO REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.85	.70	4.42	0.00	3.83	-1.76	5.34	6.49	1.15
2	0.00	3.65	2.08	.72	.74	8.92	0.00	.53	-1.76	7.18	7.70	.51
3	0.00	4.75	1.53	.85	.82	9.54	0.00	.53	-1.76	7.95	8.32	.37
4	0.00	2.73	1.39	.85	.71	9.46	0.00	.53	-1.76	5.68	8.24	2.56
5	0.00	2.55	1.36	.85	.70	4.64	0.00	.53	-1.76	5.46	3.42	-2.05
6	.49	3.65	2.08	.72	.74	9.02	.05	.53	-1.56	7.67	8.04	.37
7	.30	4.75	1.53	.85	.82	9.62	.03	.53	1.82	8.24	12.01	3.77
8	3.68	2.73	1.39	.85	.71	9.57	.37	.53	.96	9.36	11.43	2.07
9	3.68	2.47	1.32	.85	.70	4.47	.37	.53	.96	9.02	6.34	-2.68
10	0.00	3.65	2.08	.72	.74	9.12	0.00	.53	-1.76	7.18	7.89	.71
11	2.20	4.75	1.53	.85	.82	9.71	0.00	.53	-1.76	10.15	8.48	-1.66
12	0.00	2.73	1.39	.85	.71	9.67	0.00	.53	-1.76	5.68	8.44	2.77
13	0.00	2.55	1.36	.85	.70	4.69	0.00	.53	-1.76	5.46	3.47	-1.99
14	0.00	3.65	2.08	.72	.74	9.21	0.00	.53	-1.75	7.18	7.99	.81
15	0.00	4.75	1.53	.85	.82	9.79	0.00	.53	-1.76	7.95	8.57	.62
16	.49	2.73	1.39	.85	.71	9.77	.05	.53	-1.56	6.17	8.79	2.63
17	0.00	2.47	1.32	.85	.70	4.53	0.00	.53	-1.76	5.34	3.31	-2.04
18	0.00	3.65	2.08	.72	.74	9.31	0.00	.53	-1.76	7.18	8.08	.90
19	.30	4.75	1.53	.85	.92	9.87	.03	.53	1.82	8.24	12.26	4.01
20	0.00	2.73	1.39	.85	.71	9.87	0.00	.53	-1.76	5.68	8.65	2.97

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 5.98

Table 2-12

FINANCIAL APPRAISAL OF A 44 ACRE FARM UNIT ADOPTING GRAIN INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

ASSUMPTION: (1) OUTPUT VALUED AS CASH CROP.
(2) ROTATION-OATS AND BARLEY ALTERNATE IN 1ST YR, FOLLOWED BY GRAIN CORN, FABA BEANS, WINTER WHEAT
(3) FORGIVEN LOANS- 25% REPAYMENT

	COSTS($000)					BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS										
YEAR	MACHIN EQUIP	PRODUC TION	HAR VEST	LABOR	OTHER	SALES	OTHER	SUBSI DY	OPPOR. COSTS	COST	BENEFIT	NETFLOW
1	0.00	2.47	1.32	.85	.70	4.42	0.00	3.61	-1.76	5.34	6.27	.93
2	0.00	3.65	2.08	.72	.74	8.92	0.00	.31	-1.76	7.18	7.48	.29
3	0.00	4.75	1.53	.85	.82	9.54	0.00	.31	-1.76	7.95	8.10	.15
4	0.00	2.73	1.39	.85	.71	9.46	0.00	.31	-1.76	5.68	8.02	2.34
5	0.00	2.55	1.36	.85	.70	4.64	0.00	.31	-1.76	5.46	3.20	-2.27
6	.49	3.65	2.08	.72	.74	9.02	.05	.53	-1.56	7.67	8.04	.37
7	.30	4.75	1.53	.85	.82	9.62	.03	.53	1.82	8.24	12.01	3.77
8	3.68	2.73	1.39	.85	.71	9.57	.37	.53	.96	9.36	11.43	2.07
9	3.68	2.47	1.32	.85	.70	4.47	.37	.53	.96	9.02	6.34	-2.68
10	0.00	3.65	2.08	.72	.74	9.12	0.00	.53	-1.76	7.18	7.89	.71
11	2.20	4.75	1.53	.85	.82	9.71	0.00	.53	-1.76	10.15	8.48	-1.66
12	0.00	2.73	1.39	.85	.71	9.67	0.00	.53	-1.76	5.68	8.44	2.77
13	0.00	2.55	1.36	.85	.70	4.69	0.00	.53	-1.76	5.46	3.47	-1.99
14	0.00	3.65	2.08	.72	.74	9.21	0.00	.53	-1.76	7.18	7.99	.81
15	0.00	4.75	1.53	.85	.82	9.79	0.00	.53	-1.76	7.95	8.57	.62
16	.49	2.73	1.39	.85	.71	9.77	.05	.53	-1.56	6.17	8.79	2.63
17	0.00	2.47	1.32	.85	.70	4.53	0.00	.53	-1.76	5.34	3.31	-2.04
18	0.00	3.65	2.08	.72	.74	9.31	0.00	.53	-1.76	7.18	8.08	.90
19	.30	4.75	1.53	.85	.82	9.87	.03	.53	1.82	8.24	12.26	4.01
20	0.00	2.73	1.39	.85	.71	9.87	0.00	.53	-1.76	5.68	8.65	2.97

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 5.15

2.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

b) the $75 per acre loan (an outright grant if forgiveness conditions are met) has been removed from the revenue side;

c) the $20 loan forgiveness penalty is removed as a negative revenue item;

d) the fertilizer and limestone subsidy of approximately $12 per acre is removed as a revenue item.

The effect of these adjustments is to lower the base case net present values as follows:

i) from $11,290 to $5,930

ii) from $10,380 to $5,850

iii) from $5,980 to $620

iv) from $5,150 to $620.

2.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Tables 2-13 to 2-16. As indicated, the base case net present values are extremely sensitive to changes in revenue and discount rates. The base cases are somewhat less sensitive to changes in production costs and machinery and equipment costs and barely sensitive to changes in salvage values.

Table 2-13

Sensitivity Analysis
High Energy and Protein Crop Incentive
(NPV in '000 $1978)

Output Valued as Feed Replacement, Completely Forgiven Loan

Variable		Cost Benefit Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			9.97	5.93	3.81		
	BCR			1.12	1.10	1.09		
Mach & Equip	NPV	6.62	6.39	6.16	5.93	5.70	5.47	5.23
	BCR	1.12	1.11	1.11	1.10	1.10	1.09	1.09
Production Costs	NPV	10.25	8.81	7.37	5.93	4.49	3.05	1.61
	BCR	1.19	1.16	1.13	1.10	1.08	1.05	1.02
Salvage Value	NPV	5.87	5.89	5.91	5.93	5.95	5.97	5.99
	BCR	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Revenue	NPV	(5.10)	(1.42)	2.25	5.93	9.60	13.28	16.95
	BCR	.91	.98	1.04	1.10	1.16	1.23	1.29

Variable		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			16.88	11.29	8.29		
	BCR			1.19	1.19	1.19		
Mach & Equip	NPV	11.99	11.75	11.52	11.29	11.06	10.83	10.59
	BCR	1.20	1.20	1.19	1.19	1.18	1.18	1.17
Production Costs	NPV	15.61	14.17	12.73	11.29	9.85	8.41	6.97
	BCR	1.28	1.25	1.22	1.19	1.16	1.13	1.11
Salvage Value	NPV	11.23	11.25	11.27	11.29	11.31	11.33	11.35
	BCR	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Revenue	NPV	.26	3.94	7.61	11.29	14.97	18.64	22.32
	BCR	1.00	1.06	1.13	1.19	1.25	1.31	1.37

Note: Figures in brackets denote negative values.

Table 2-14

Sensitivity Analysis
High Energy and Protein Crop Incentive
(NPV in '000 $1978)

Output Valued as Feed Replacement, partially Forgiven Loan

Cost-Benefit Analysis

Variable		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			9.79	5.85	3.77		
	BCR			1.11	1.10	1.09		
Mach & Equip	NPV	6.54	6.31	6.08	5.85	5.62	5.39	5.15
	BCR	1.11	1.11	1.10	1.10	1.10	1.09	1.09
Production Costs	NPV	10.17	8.73	7.29	5.85	4.41	2.97	1.53
	BCR	1.19	1.16	1.13	1.10	1.07	1.05	1.02
Salvage Value	NPV	5.79	5.81	5.83	5.85	5.87	5.89	5.91
	BCR	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Revenue	NPV	(5.18)	(1.50)	2.17	5.85	9.52	13.20	16.88
	BCR	.91	.97	1.04	1.10	1.16	1.23	1.29

Financial Analysis

Variable		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			15.75	10.38	7.52		
	BCR			1.18	1.17			
Mach & Equip	NPV	11.07	10.84	10.61	10.38	10.14	9.91	9.68
	BCR	1.19	1.18	1.18	1.17	1.17	1.16	1.16
Production Costs	NPV	14.70	13.26	11.82	10.38	8.94	7.50	6.06
	BCR	1.26	1.23	1.20	1.17	1.14	1.12	1.09
Salvage Value	NPV	10.32	10.34	10.36	10.38	10.40	10.42	10.43
	BCR	1.17	1.17	1.17	1.17	1.17	1.17	1.17
Revenue	NPV	(.65)	5.03	6.70	10.38	14.05	17.73	21.40
	BCR	.99	1.05	1.11	1.17	1.23	1.29	1.36

Note: Figures in brackets denote negative values.

Table 2-15

Sensitivity Analysis
High Energy and Protein Crop Incentive
(NPV in '000 $1978)

Output Valued as Cash Crop, Completely Forgiven Loan

Variable		Cost-Benefit Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			2.15	.62	(.08)		
	BCR			1.02	1.01	.99		
Mach & Equip	NPV	1.31	1.00	.85	.62	.39	.15	(.08)
	BCR	1.02	1.02	1.01	1.01	1.01	1.00	.99
Production Costs	NPV	4.94	3.50	2.06	.62	(.82)	(2.26)	(3.70)
	BCR	1.09	1.06	1.04	1.01	.99	.96	.94
Salvage Costs	NPV	.56	.58	.60	.62	.64	.66	.68
	BCR	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Revenue	NPV	(9.61)	(6.20)	(2.79)	.62	4.03	7.44	10.85
	BCR	.83	.89	.95	1.01	1.07	1.13	1.19

Variable		Financial Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			9.06	5.98	4.40		
	BCR			1.10	1.10	1.10		
Mach & Equip	NPV	6.67	6.44	6.21	5.98	5.75	5.52	5.28
	BCR	1.11	1.11	1.10	1.10	1.10	1.09	1.09
Production Costs	NPV	10.30	8.86	7.42	5.98	4.54	3.10	1.66
	BCR	1.18	1.15	1.13	1.10	1.07	1.05	1.02
Salvage Costs	NPV	5.92	5.94	5.96	5.98	6.00	6.02	6.04
	BCR	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Revenue	NPV	(4.25)	(.84)	2.57	5.98	9.39	12.80	16.21
	BCR	.93	.99	1.04	1.10	1.16	1.21	1.27

Note: Figures in brackets denote negative values.

Table 2-16

Sensitivity Analysis
High Energy and Protein Crop Incentive
(NPV in '000 $1978)

Output Valued as Cash Crop, Partially Forgiven Loan

Variable		Cost-Benefit Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			2.15	.62	(.08)		
	BCR			1.02	1.01	.99		
Mach & Equip	NPV	1.31	1.08	.85	.62	.39	.15	(.08)
	BCR	1.02	1.02	1.01	1.01	1.01	1.00	.99
Production Costs	NPV	4.94	3.50	2.06	.62	(.82)	(2.26)	(3.70)
	BCR	1.09	1.06	1.04	1.01	.99	.96	.94
Salvage Value	NPV	.56	.58	.60	.62	.64	.66	.68
	BCR	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Revenue	NPV	(9.61)	(6.20)	(2.79)	.62	4.03	7.44	10.85
	BCR	.83	.89	.95	1.01	1.07	1.13	1.19

Variable		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			8.10	5.15	3.66		
	BCR			1.09	1.08	1.08		
Mach & Equip	NPV	5.84	5.61	5.38	5.15	4.91	4.68	4.45
	BCR	1.10	1.09	1.09	1.08	1.08	1.08	1.07
Production Costs	NPV	9.46	8.03	6.59	5.15	3.71	2.27	.83
	BCR	1.17	1.14	1.11	1.08	1.06	1.04	1.01
Salvage Value	NPV	5.09	5.11	5.13	5.15	5.17	5.18	5.20
	BCR	1.08	1.08	1.08	1.08	1.08	1.09	1.09
Revenue	NPV	(5.08)	(1.67)	1.74	5.15	8.56	11.97	15.38
	BCR	.92	.97	1.03	1.08	1.14	1.20	1.26

Note: Figures in brackets denote negative values.

3.0 Feed Facility Incentive

3.1 Sector Profile

Prior to the Subsidiary Agreement of 1976, there was little pressure on producers to purchase on-farm milling, storing and drying units. Tables 2-1 and 2-2 indicate that for the most part grain acreages were declining and reliance on imported feeds was increasing up to and including 1976. Whatever feed the farmer needed could easily be purchased from commercial sources. Furthermore, the heavy capital outlays required for such facilities served to inhibit many producers from purchasing them.

Similarly, in the case of silos and silage feeding systems, the heavy capital outlays served as a deterrent to their uptake. Moreover, Nova Scotian farmers traditionally employed small bale handling and feeding systems in their enterprises. Not only was cost a factor, but also tradition.

Hay driers, on the other hand, require relatively small amounts of capital and minor structural changes to existing facilities in their usage. No information exists on the extent of hay drier use prior to the Subsidiary Agreement. However, it would appear that extension services would play an important role in their uptake.

With the identification of opportunities for a more efficient utilization of Nova Scotia's land base and a subsequent increase in domestic feed grain production, a need for on-farm feed facilities was recognized. The provision of capital grants was intended to ease the burden of heavy capital acquisition.

3.2 Project Description

3.2.1 Objectives

The purpose of the Feed Facility Incentive Programme is:

a) to encourage the establishment of on-farm facilities for drying, storing and milling grain, for drying livestock fodder and for storing silage and high moisture grain.

This programme is related to the stated target of the High Energy and Protein Crop Incentive in that:

a) it is expected that at least 18,000 acres (one half of target acreage) of high energy and protein crops will be stored and/or processed in on-farm facilities constructed under this project.

Expected benefits of the Programme are outlined in Schedule "A" as follows:

In the Nova Scotia context, high energy and protein crops can most profitably be grown and utilized as part of a production unit. To be fully integrated, on-farm drying, storage and milling facilities are necessary and will eliminate major transportation costs.

To assist with the installation of these facilities assistance in the form of capital grants is available to producers.

Qualifications for grant assistance is based on the following condition:

a) applicants must have had a gross income in excess of $10,000 per year from the sale of agricultural products, or have obtained more than 50 percent of their gross income from agriculture.

Assistance is provided in the form of capital grants paid on the basis of 50 percent of costs to a maximum of $6,000 per farm per year to a maximum of $12,000 during the length of the programme. The following facilities are eligible for construction:

a) grain driers
b) milling and storage facilities
c) silos
d) hay driers

The estimated five year cost of the Programme was $5.4 million to be divided as follows:

Federal Share	Provincial Share	Producers' Share
$2,160,000	$540,000	$2,700,000

Table 3-1

Feed Facility Incentive Programme
Feed Facilities Constructed 1976-1979

	Milling and Storage Units and Grain Dryers	Silos	Hay Driers
1976	83	67	8
1977	99	75	32
1978	50	56	41
1979	63	54	60
TOTAL	295	252	141

Source: Annual Reports

Table 3-2

Feed Facility Incentive Programme
Total Combined Government and Farm Share Expenditures Incurred
1976 - 1979

	Government Share %[1]	Government Share ('000)	Farm Share %	Farm Share ('000)	Combined Expenditures All Farms ('000)
Milling and Storage Units and Grain Driers	35.8		64.2		
1976		166.3		298.2	464.5
1977		250.5		449.2	699.7
1978		124.6		223.4	348.0
1979		223.4		400.6	624.0
SUB TOTAL		764.8		1,371.4	2,136.2
Silos	38.2		61.8		
1976		226.5		366.4	592.9
1977		308.8		499.6	808.4
1978		264.1		427.3	691.4
1979		375.4		607.3	982.7
SUB TOTAL		1,174.8		1,900.6	3,075.4
Hay Driers	50.0[2]		50.0		
1976		11.5		11.5	23.0
1977		45.6		45.6	91.2
1978		47.8		47.8	95.6
1979		80.7		80.7	161.4
SUB TOTAL		185.6		185.6	371.2
TOTAL		2,125.2		3,457.6	5,582.8

Source: Annual Reports, Survey.

Notes:
1. Percentage shares of combined expenditure for milling and storage units and grain driers, and silos by the government and farm sectors were determined from the survey.
2. A 50:50 cost sharing arrangement assumed.
3. Government expenditures were determined from the Annual Reports.

3.2.2 Project Performance

The number of on-farm feed facilities constructed, and costs incurred over the first four years of the Programme are summarized in Table 3-1 and 3-2. From Table 3-2 it can be seen that the five year estimated cost of the Programme has been exceeded by $182,800 after the first four years. However, Table 3-2 indicates that there is still $34,800 of Government money available for year five. The reason for the cost overrun is that the cost sharing ratio of 50:50 between government and the farm sector did not hold. The Survey indicated that the producers had to bear a proportionately heavier expenditure on grain driers, milling and storage units and silos.

It would appear that the Programme has, for all intents and purposes, achieved its five year objective after four years with respect to expenditures. However, it is not possible to evaluate the success of the Programme with respect to the number of bushels stored because of the very aggregated and general nature of the Annual Report data. The Survey provides some rough information with regard to this.

A point worthy of note concerning the Feed Facility Programme is the high number of repeat participants. After the first three years of the Programme there were 511 applications for assistance. Out of this number there were 344 actual participants. A likely explanation for this is the $6,000 grant limit in a given year.

3.2.3 Participant Profile

A profile of the average participant based on information contained in the Survey is presented in Table 3-3. This information covers the first three years of the Programme and is based on a sample of 25 producers, approximately 7 percent of total participants (344) up to that point. The information presented here provides a rough indication only of the average operation. For a more detailed description of participants see Sorflaten 1980.

The most significant points to note about the average participant in the Feed Facility Programme are as follows:*

a) the farm employed 2 persons;

b) off-farm work was relatively high for those who reported;

c) average total cost of grain storage purchased was $9,261.11 with an average capacity of 9,181.11 bushels;

d) average total cost of grain mill was $4,287.50 with an average amount of throughput in 1978 of 5,165 bushels;

e) average total cost of drier facility was $4,218.75 with an average amount of 12,023.67 bushels dried by this facility;

f) average total cost of vertical silo was $26,750 with an average capacity of 841.25 tonnes;

g) average total cost of horizontal silo was $7,731.14 with an average capacity of 513.29 tonnes;

h) of 11 respondents who purchased silos, 73 percent changed their feeding system from hay to silage;

i) participation was dominated by those with sales above $75,000;

j) participants were primarily dairy (16), beef (7) and hogs (5);

k) 67 percent of the 18 producers who responded to this question indicated they would have undertaken the project without assistance.

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* The Survey deals only with participants who purchased grain drying and milling and storage units, and silos. Hay driers are not included.

Table 3-3

Profile of Average Participant
Feed Facility Incentive Programme

Item	Number of Responses	Average Measure	Average Percentage
1. Age of operator	25	44.48 years	-
2. Type of farm: family	13		
partnership	4		
3. Total land area operated	25	552.04 acres	
4. Value of land and buildings	25	$272,230	
5. Value of machinery and equipment	25	$82,298	
6. Total cattle and calves	23	119.7 head	
7. Cows and heifers for milking	16	79.31 head	
8. Total pigs	5	706.6 head	
9. Sows for breeding purposes	4	58.75 head	
10. Total sheep and lambs	1	178 head	
11. Total chickens	1	430 head	
12. Labour: employees	10	2 persons	
Week paid labour - male	23	60.43 weeks	
female	1	12 weeks	
13. Off-farm work	4	175 days	
14. Value of products sold:			
0-24,999	4		22.3
25,000-49,000	1		5.6
50,000-74,000	3		16.7
75,000 and over	10		55.6

3.3 Methodology

3.3.1 Methodological Issues

The Cost-Benefit Analysis of the Feed Facility Incentive is composed of three distinct sections:

a) silos - vertical and horizontal
b) grain drying, milling and storing
c) hay driers

In general, the above sections conform to the conventional approach outlined in Chapter Two. However, with respect to the evaluation of silos, there are significant differences which should be mentioned:

a) The analysis of silos was based on cost-effectiveness rather than the conventional net present value approach. That is to say, the alternatives were assessed in light of their relative costs. The revenue stream is excluded from the analysis.

b) The standard against which the vertical and horizontal silos were measured was the traditional small bale handling system. Various tonnages of silage or hay were harvested and fed by the systems and compared.

Grain drying, milling and storage units, and hay driers followed the conventional approach.

Incremental capital and operating costs and revenues (except in the silo evaluation) were estimated using historical data and by simulating the operation of these facilities in an on-farm context over the twenty year evaluation period. The results of this analysis were generalized to all participating producers and on adjustment made for incrementality in order to assess the performance of the overall programme.

3.3.2 Assumptions

Since the Feed Facility Incentive was comprised of three distinct programmes, it was necessary to create three different sets of assumptions. The following assumptions were made in carrying out the Cost-Benefit Analysis:

Silos

a) Unit Size: two silage systems were compared against the traditional small bale handling system.

i) vertical silos: it was assumed that a 7.5m x 24m silo with a capacity of 862 tonnes of 35 percent dry matter was utilized.

ii) horizontal silos: it was assumed that a 9m x 3m x 31.8m silo with a capacity of 500 tonnes of 35 percent dry matter was utilized.

These silo capacities were derived from Survey data. A typical mow and stanchion small bale system was assumed.

b) Base Year: all cost projections are expressed in 1978 constant dollars.

c) Throughput Handled: The throughput handled was dictated by the capacity of the silo.

i) vertical silos: bases examined were 100, 250, 500 and 750 tonnes of 35 percent dry matter silage being handled and fed.

ii) horizontal silos: because of capacity constraints cases examined were 100, 250 and 500 tonnes of 35 percent dry matter silage being handled and fed.

iii) small bale system: this being the control case 100, 250, 500 and 750 tonnes of hay were harvested and fed.

d) Investment Costs:

i) vertical silos: all investment costs were derived from the publication Forage Handling Systems for Grass and Legumes 1979-80. Investments made were:

Year 1	silo - basic cost		$24,057
	unloader and tapered board		
		100 tonnes	6,800
		250 tones	8,600
		500 tonnes	13,200
		750 tonnes	17,800
	harvest and hauling		
		forage harvester	5,925
		2 silage wagons	20,000
	silo filling		
		blower	2,300
		distributor	750
		forage box	4,000
Year 7	silo unloader		4,000

Year 13	unloader and tapered board	
	- as above for various tonnages	
	harvest and hauling	
	- as above	
	silo filling	
	- as above	
Year 19	silo unloader	4,000

ii) horizontal silos: all investment costs were derived from the publication Forage Handling Systems for Grass and Legumes 1979-80. Investments made were:

Year 1	silo - basic cost	$8,810
	bunk	820
	taper-bed chain feeder	2,030
	plastic (annual expense)	90
	harvest and hauling	
	forage harvester	5,925
	2 forage wagons	20,000
	silo filling	
	front-end loader	2,250
Year 7	taper-bed chain feeder	2,030
Year 13	taper-bed chain feeder	
	- as above	
	harvest and hauling	
	- as above	
	silo filling	
	- as above	
Year 19	taper-bed chain feeder	2,030

iii) small bale handling system: all investment costs were derived from the publication Forage Handling Systems for Grass and Legumes 1979-80. Investments made were:

Year 1	mower conditions	$6,425
	wheel rake	1,600
	baler	5,300
	bale thrower	1,750
	2 wagons	1350
	bale elevator	1,650
Year 13	same investments made.	

e) Operating Costs:

i) insurance and repairs: these costs were calculated in accordance with the methodology suggested in the Farm Management crop sheets. This method was used in all cases.

ii) harvest costs: harvest costs are comprised of both the actual harvest costs plus the costs of hauling to the storage area. These costs were derived from Forage Handling Systems for Grass and Legumes 1979-80.

iii) silo filling and unloading: these costs are self-explanatory and were derived from Forage Handling Systems for Grass and Legumes 1979-80.

iv) skilled labour: skilled labour was valued at \$5.00 per hour. Man hours per tonne coefficients were derived from Forage Handling Systems for Grass and Legumes 1979-80. It was assumed that any labour used in the operation of most equipment was skilled. In year 1 of the vertical and horizontal silo segments a labour component of silo construction costs was included. This component was assumed to be 35 percent of the cost of the basic storage unit.

v) unskilled labour: unskilled labour was valued at \$3.00 per hour. Man hours per tonne coefficients were derived from Forage Handling Systems for Grass and Legumes 1979-80. Both skilled and unskilled labour were isolated from total harvest, and silo filling and unloading costs.

vi) other costs: other costs were composed of taxes in the vertical silo case and both taxes and the cost of plastic in the horizontal silo case (\$90/year). Taxes were composed of a materials and equipment tax in year 1 assumed to be 15 percent of the cost of materials and a building tax of 1 percent per annum on the completed structure.

f) Subsidy: the subsidy column was the only income item included in the evaluation. Since this programme was being evaluated from a cost effectiveness basis the subsidy was entered as a negative so as to reduce costs. In the case of vertical silos the subsidy appeared in both year 1 and 2. This was due to the fact that the maximum allowable grant in one year was \$6,000.

Also included with the subsidy as income items were the salvage values of expended equipment. These appeared in years 7, 13 and 19. The salvage value was assumed to be 10 percent of replacement costs.

Grain Drying, Milling and Storage Units

a) Type of Unit: Survey data indicated that 60 percent of survey participants did not purchase grain driers along with milling and storage units. The twenty year evaluation is therefore based on the two cases:

i) grain drying, milling and storage unit
ii) milling and storage operation

b) Base Year: all cost and benefit projections are expressed in 1978 constant dollars.

c) Throughput Handled: Survey data indicated that the average participant handled in the vicinity of 5,000 bushels or 108.86 tonnes of grain through the facility in a year.

d) Investment Costs: investment cost data were derived from Farm Management and Agriculture Canada publications. Machinery and equipment costs were either inflated or deflated to 1978 dollars by the Farm Input Price Index. Some machinery was replaced after 12 years. Investments were as follows:

i) grain drying, milling and storage unit

	Year 1	Year 13
19-foot drying bin complete	$ 4,890	$ 3,218.90
electric blender-grinder		
mix mill	2,404.50	2,404.50
5 augers	858.75	858.75
controls	229	229
wiring	805	805
storage		
2 19-foot bins	3,002.91	
2 concrete pads	339.30	
2 aeration pads	1,423.64	
processed feed bin		
1 pad	169.65	
1 feed bin	794	

ii) milling and storage operation

	Year 1	Year 13
electric blender-grinder		
mix mill	2,404.50	2,404.50
4 augers	687	687
controls	229	229
wiring	805	805
storage		
2 19-foot bins	3,002.91	
2 control pads	339.50	
2 aeration pads	1,423.64	
processed feed bin		
1 pad	169.65	
1 feed bin	794	

e) Operating Costs:

i) Energy: energy costs included the cost of propane and electricity to dry grain, and the cost of electricity to run the blender-grinder. Energy costs were assumed to be:

a) grain drying, million and storage unit

grain drying		
	propane	114.90
	electricity	9.57
electric blender-grinder		
	electricity	43.54

b) milling and storage operation

electric blender-grinder		
	electricity	43.54

ii) Skilled labour: skilled labour was valued at $5.00 per hour. It was assumed that all labour was skilled, as the operation of reasonably sophisticated equipment was involved. Labour requirements were derived from Farm Management and Agriculture Canada publications.

iii) Insurance and repairs: these costs were calculated in accordance with the methodology suggested in the Farm Management crop sheets.

f) Benefits:

i) Subsidy: the subsidy was based on 50 percent of capital costs. The maximum amount payable in one year was $6,000. Therefore, in the case of grain drying, milling and storage units, the subsidy was paid over two years.

ii) Savings: the benefits of these facilities were quantified by assessing the savings of having on-farm feed facilities to produce feed as compared to purchasing a commercial ration. The basis for comparison was a purchased 16 percent protein dairy ration and an on-farm formulated standard dairy ration which provided the same nutrients.

Differences in savings were also attributable to whether or not the producers had a grain dryer. In this evaluation it was assumed that if the producer did not have a grain drier he would have to purchase barley and oats from commercial sources. If an on-farm drier existed the cost of barley and oats would presumable only reflect costs of production and harvesting. Savings realized in both cases were as follows:

grain drying, milling and storage unit

Standard Ration 16% Dairy

	kg	cost/tonne	ingredient cost/tonne
barley	305	121.51	37.06
corn	230	147.15	33.84
oats	180	121.32	21.84
soybean 49%	120	301.86	36.22
bran	90	168.00	15.12
molasses	45	102.20	4.60
di cal phosphate	20	206.67	4.13
salt	10	52.50	.52
	1,000 kg		153.33

16 percent dairy ration (commercial)

173.75 + \$8.00 (transport) = \$181.75

Savings = 181.75 - 153.33 = \$28.42/tonne

for 5,000 bushels or 108.86 tonnes

\$28.42 x 108.86 = \$3,093.80

- barley, corn and oats were valued according to production and harvest costs
- all other inputs were purchased

Cost information was derived from the Farm Management Advisory Manual

milling and storage operation

	kg	cost/tonne*	ingredient cost/tonne
barley	305	122.33	37.31
corn	230	147.15	33.84
oats	180	127.37	22.93
soybean 49%	120	301.86	36.22
bran	90	168.00	15.12
molasses	45	102.20	4.60
di cal phosphate	20	206.67	4.13
salt	10	52.50	.52
	1,000 kg		154.64

16 percent dairy ration (commercial)

173.75 + \$8.00 = \$181.75

Savings = 181.75 - 154.64 = \$27.11/tonne

for 5,000 bushesl or 108.86 tonnes

\$27.11 x 108.86 = \$2,951.19

*The costs per tonne of barley and oats were altered to reflect a commercial price plus a transport component. The differences between the purchased and on-farm costs were quite small. Cost information was obtained from Farm Management sources.

iii) Other benefits: other benefits were assumed to be the salvage values of equipment replaced in year 13. Salvage value was assumed to be 10 percent of replacement cost.

Hay Driers

a) Unit Size: a 5 h.p. fan was used to dry hay cut from 100 acres to 20 percent moisture content or less. The 5 h.p. motor was found to be most popular in the Maritimes.

b) Base Year: all cost and benefit projections are expressed in 1978 constant dollars.

c) Drying Period: hay was put in to be dried at 40 percent moisture. A drying period of 25 days was required to bring the hay to a 20 percent moisture content.

d) Investment Costs:

i) Construction costs: all capital costs were included under construction costs. These costs were:

5 h.p. hay drier	$1,500
electrical entrance	$1,580
duct (100 foot barn)	$ 820

These costs were based on Agriculture Canada publications and the advice of Nova Scotia Department of Agriculture and Marketing personnel.

The hay drier was replaced in year 11.

e) Operating Costs:

i) Electricity: it was assumed that the hay drier cost $.112 per hour to operate under full load.

$$.112 \times 24 \text{ hours} \times 25 \text{ days} = \$67.20$$

ii) Insurance and repairs: machinery repair and insurance expenses were calculated according to the methodology presented in the Farm Management crop sheets.

iii) Subsidy: the subsidy was based on 50 percent of allowable capital costs. This amount was paid in year 1.

iv) Difference: this column was designed to reflect the additional benefits of using a hay drier as compared to letting the hay field cure. The benefits of a properly managed hay drier were assumed to be:

1. reduce dry matter losses
2. eliminate heating and molds
3. minimize heat loss
4. shorten field drying time

To assess the difference it was assumed that there was a 30 percent loss of feeding value by letting the hay field cure. The use of a hay drier reduced this loss to 5 percent. The difference for 100 acres was calculated as follows:

normal yield - 3 tonnes/acre
value per tonne - $50

30% loss without hay drier - 2.1 tonnes/acre

value = $10,500/100 acres

5% loss with hay drier - 2.85 tonnes/acre

value = $14,250/100 acres

Difference (benefit) = $3,750/100 acres

v) Other: other benefits were comprised of the salvage value of the hay drier. Salvage value was assumed to be 10 percent of replacement cost.

3.4 Results

The Feed Facility Incentive Programme is comprised of three distinct projects:

A. Silos - Vertical and Horizontal
B. Grain Drying, Milling and Storing
C. Hay Driers.

As indicated in Section 3.3, there are some differences in methodology from the conventional approach. This is most evident in the examination of the incentive provided for silo construction. The results of the Cost-Benefit Analyses for these projects are as follows:

A. SILO CONSTRUCTION

3.4.1 Cost-Benefit Analysis

The silo construction project is not analyzed according to costs and benefits. Instead, the project is examined from a cost effectiveness point of view. What this implies is that the three scenarios presented are judged according to the net present value of costs involved. The three scenarios, or choices, are examined in light of relative costs of handling 100, 250, 500 or 750 tonnes of forage in a year.

	Tonnes Handled and Fed
i) vertical silos	100
	250
	500
	750
ii) horizontal silos	100
	250
	500
iii) small bale system	100
	250
	500
	750

The small bale system serves as a decision variable in that its relative costs represent an alternative to the silo-silage system.

Table 3-4

ECONOMIC APPRAISAL OF A SMALL BALE HANDLING SYSTEM
100 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

COSTS($000)

YEAR	INVESTMENT: MACHINE& EQUIP.	OPERATING COSTS: LOADING	INSURANCE REPAIRS	HARVEST	SKILL LABOUR	UNSKILL LABOUR	OTHER	NETFLOW
1	18.08	1.46	1.17	3.43	.27	.26	0.00	-24.66
2	0.00	1.46	1.17	3.43	.27	.26	0.00	-6.59
3	0.00	1.46	1.17	3.43	.27	.26	0.00	-6.59
4	0.00	1.46	1.17	3.43	.27	.26	0.00	-6.59
5	0.00	1.46	1.17	3.43	.27	.26	0.00	-6.59
6	0.00	1.46	1.17	3.43	.27	.26	0.00	-6.59
7	0.00	1.46	1.17	3.43	.27	.26	0.00	-6.59
8	0.00	1.46	1.17	3.43	.27	.26	0.00	-6.59
9	0.00	1.46	1.17	3.43	.31	.30	0.00	-6.68
10	0.00	1.46	1.17	3.43	.33	.32	0.00	-6.72
11	0.00	1.46	1.17	3.43	.35	.34	0.00	-6.75
12	0.00	1.46	1.17	3.43	.38	.36	0.00	-6.81
13	18.08	1.46	1.17	3.43	.04	.38	-1.81	-22.76
14	0.00	1.46	1.17	3.43	.40	.38	0.00	-6.85
15	0.00	1.46	1.17	3.43	.40	.38	0.00	-6.85
16	0.00	1.46	1.17	3.43	.40	.38	0.00	-6.85
17	0.00	1.46	1.17	3.43	.40	.38	0.00	-6.85
18	0.00	1.46	1.17	3.43	.40	.38	0.00	-6.85
19	0.00	1.46	1.17	3.43	.40	.38	0.00	-6.85
20	0.00	1.46	1.17	3.43	.40	.38	0.00	-6.85

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -77.79

Table 3-5

ECONOMIC APPRAISAL OF FEED FACILITY INCENTIVE POLICY
HORIZONTAL SILO: 250 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

COSTS($000)

YEAR	INVESTMENT		OPERATING COSTS								
	STORAGE FEEDOUT	LOADING	TAXES	INSU REPAIRS	HARVEST	SILOFIL UNLOAD	SKILL LABOR	UNSKILL LABOR	SUBSIDY	OTHER	NET FLOW
1	7.92	28.18	0.00	2.21	3.01	1.13	2.64	0.00	0.00	0.00	-45.08
2	.09	0.00	0.00	2.21	3.01	1.13	.79	0.00	0.00	0.00	-7.23
3	.09	0.00	0.00	2.21	3.01	1.13	.79	0.00	0.00	0.00	-7.23
4	.09	0.00	0.00	2.21	3.01	1.13	.79	0.00	0.00	0.00	-7.23
5	.09	0.00	0.00	2.21	3.01	1.13	.79	0.00	0.00	0.00	-7.23
6	.09	0.00	0.00	2.21	3.01	1.13	.79	0.00	0.00	0.00	-7.23
7	2.12	0.00	0.00	2.21	3.01	1.13	.79	0.00	0.00	-.20	-9.05
8	.09	0.00	0.00	2.21	3.01	1.13	.79	0.00	0.0	0.00	-7.23
9	.09	0.00	0.00	2.21	3.01	1.13	.92	0.00	0.00	0.00	-7.35
10	.09	0.00	0.00	2.21	3.01	1.13	.98	0.00	0.00	0.00	-7.42
11	.09	0.00	0.00	2.21	3.01	1.13	1.05	0.00	0.00	0.00	-7.49
12	.09	0.00	0.00	2.21	3.01	1.13	1.12	0.00	0.00	0.00	-7.55
13	2.12	28.18	0.00	2.21	3.01	1.13	1.18	0.00	0.00	-3.02	-34.80
14	.09	0.00	0.00	2.21	3.01	1.13	1.18	0.00	0.00	0.00	-7.62
15	.09	0.00	0.00	2.21	3.01	1.13	1.18	0.00	0.00	0.00	-7.62
16	.09	0.00	0.00	2.21	3.01	1.13	1.18	0.00	0.00	0.00	-7.62
17	.09	0.00	0.00	2.21	3.01	1.13	1.18	0.00	0.00	0.00	-7.62
18	.09	0.00	0.00	2.21	3.01	1.13	1.18	0.00	0.00	0.00	-7.62
19	2.12	0.00	0.00	2.21	3.01	1.13	1.18	0.00	0.00	-.20	-9.45
20	.09	0.00	0.00	2.21	3.01	1.13	1.18	0.00	0.00	0.00	-7.62

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -106.04

Table 3-6

ECONOMIC APPRAISAL OF FEED FACILITY INCENTIVE POLICY
HORIZONTAL SILO: 500 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

COSTS($000)

YEAR	INVESTMENT: STORAGE FEEDOUT	INVESTMENT: LOADING	OPERATING COSTS: TAXES	INSU REPAIRS	HARVEST	SILOFIL UNLOAD	SKILL LABOR	UNSKILL LABOR	SUBSIDY	OTHER	NET FLOW
1	7.92	28.18	0.00	2.21	3.87	1.97	3.43	0.00	0.00	0.00	-47.56
2	.09	0.00	0.00	2.21	3.87	1.97	1.58	0.00	0.00	0.00	-9.71
3	.09	0.00	0.00	2.21	3.87	1.97	1.58	0.00	0.00	0.00	-9.71
4	.09	0.00	0.00	2.21	3.87	1.97	1.58	0.00	0.00	0.00	-9.71
5	.09	0.00	0.00	2.21	3.87	1.97	1.58	0.00	0.00	0.00	-9.71
6	.09	0.00	0.00	2.21	3.87	1.97	1.58	0.00	0.00	0.00	-9.71
7	.21	0.00	0.00	2.21	3.87	1.97	1.58	0.00	0.00	-.20	-9.63
8	.09	0.00	0.00	2.21	3.87	1.97	1.58	0.00	0.00	0.00	-9.71
9	.09	0.00	0.00	2.21	3.87	1.97	1.84	0.00	0.00	0.00	-9.97
10	.09	0.00	0.00	2.21	3.87	1.97	1.97	0.00	0.00	0.00	-10.10
11	.09	0.00	0.00	2.21	3.87	1.97	2.10	0.00	0.0	0.00	-10.23
12	.09	0.00	0.00	2.21	3.87	1.97	2.23	0.00	0.00	0.00	-10.36
13	.21	28.18	0.00	2.21	3.87	1.97	2.36	0.00	0.00	-.30	-38.49
14	.09	0.00	0.00	2.21	3.87	1.97	2.36	0.00	0.00	0.00	-10.49
15	.09	0.00	0.00	2.21	3.87	1.97	2.36	0.00	0.00	0.00	-10.49
16	.09	0.00	0.00	2.21	3.87	1.97	2.36	0.00	0.00	0.00	-10.49
17	.09	0.00	0.00	2.21	3.87	1.97	2.36	0.00	0.00	0.00	-10.49
18	.09	0.00	0.00	2.21	3.87	1.97	2.36	0.00	0.00	0.00	-10.49
19	.21	0.00	0.00	2.21	3.87	1.97	2.36	0.00	0.00	-.20	-10.41
20	.09	0.00	0.00	2.21	3.87	1.97	2.36	0.00	0.00	0.00	-10.49

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -127.10

Table 3-7

ECONOMIC APPRAISAL OF FEED FACILITY INCENTIVE POLICY
VERTICAL SILO: 750 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

COSTS($000)

	INVESTMENT		OPERATING COSTS								
YEAR	STORAGE FEEDOUT	LOADING	TAXES	INSU REPAIRS	HARVEST	SILOFIL UNLOAD	SKILL LABOR	UNSKILL LABOR	SUBSIDY	OTHER	NET FLOW
1	31.40	32.98	0.00	3.77	4.64	4.40	6.54	.57	0.00	0.00	-84.29
2	0.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	0.00	-14.86
3	0.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	0.00	-14.86
4	0.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	0.00	-14.86
5	0.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	0.00	-14.86
6	0.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	0.00	-14.86
7	4.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	0.00	-14.86
8	0.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	-.40	-18.46
9	0.00	0.00	0.00	3.77	4.64	4.40	1.49	.57	0.00	0.00	-14.86
10	0.00	0.00	0.00	3.77	4.64	4.40	1.73	.66	0.00	0.00	-15.20
11	0.00	0.00	0.00	3.77	4.64	4.40	1.86	.71	0.00	0.00	-15.37
12	0.00	0.00	0.00	3.77	4.64	4.40	1.98	.75	0.00	0.00	-15.54
13	17.80	32.98	0.00	3.77	4.64	4.40	2.10	.80	0.00	0.00	-17.71
14	0.00	0.00	0.00	3.77	4.64	4.40	2.23	.85	0.00	-5.08	-61.58
15	0.00	0.00	0.00	3.77	4.64	4.40	2.23	.85	0.00	0.00	-15.88
16	0.00	0.00	0.00	3.77	4.64	4.40	2.23	.85	0.00	0.00	-15.88
17	0.00	0.00	0.00	3.77	4.64	4.40	2.23	.85	0.00	0.00	-15.88
18	0.00	0.00	0.00	3.77	4.64	4.40	2.23	.85	0.00	0.00	-15.88
19	4.00	0.00	0.00	3.77	4.64	4.40	2.23	.85	0.00	0.00	-15.88
20	0.00	0.00	0.00	3.77	4.64	4.40	2.23	.85	0.00	-.40	-19.48
								.85	0.00	0.00	-15.88

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -207.87

From an economic point of view the decision matrix is as follows:

System	Tonnes Handled and Feed 100	250	500	750
Vertical Silo	(\$124,330)	(\$140,670)	(\$169,560)	(\$207,870)*
Horizontal Silo	(\$ 93,070)	(\$106,040)*	(\$127,100)*	
Small Bale System	(\$ 77,790)*	(\$114,030)	(\$180,000)	(\$235,730)

Note: * asterisk denotes cost effective system for given tonnage.

These same results are presented in Figure 3-1 in graphic form. The results indicate, in economic terms, that the small bale system is cheapest for 100 tonnes handled and fed. For 250 tonnes handled and fed a crossover of feeding systems is indicated. The horizontal silo is cost-effective at this feeding level. Similarly, for 500 tonnes handled and fed, the horizontal silo is definitely cost effective. In the case of 750 tonnes handled and fed the vertical silo is cost-effective. A net present value of costs for the horizontal silo does not exist because it would entail greater capacity than assumed in the model.

The cost effective base cases are presented in Tables 3-4 to 3-7 in a cash flow format.

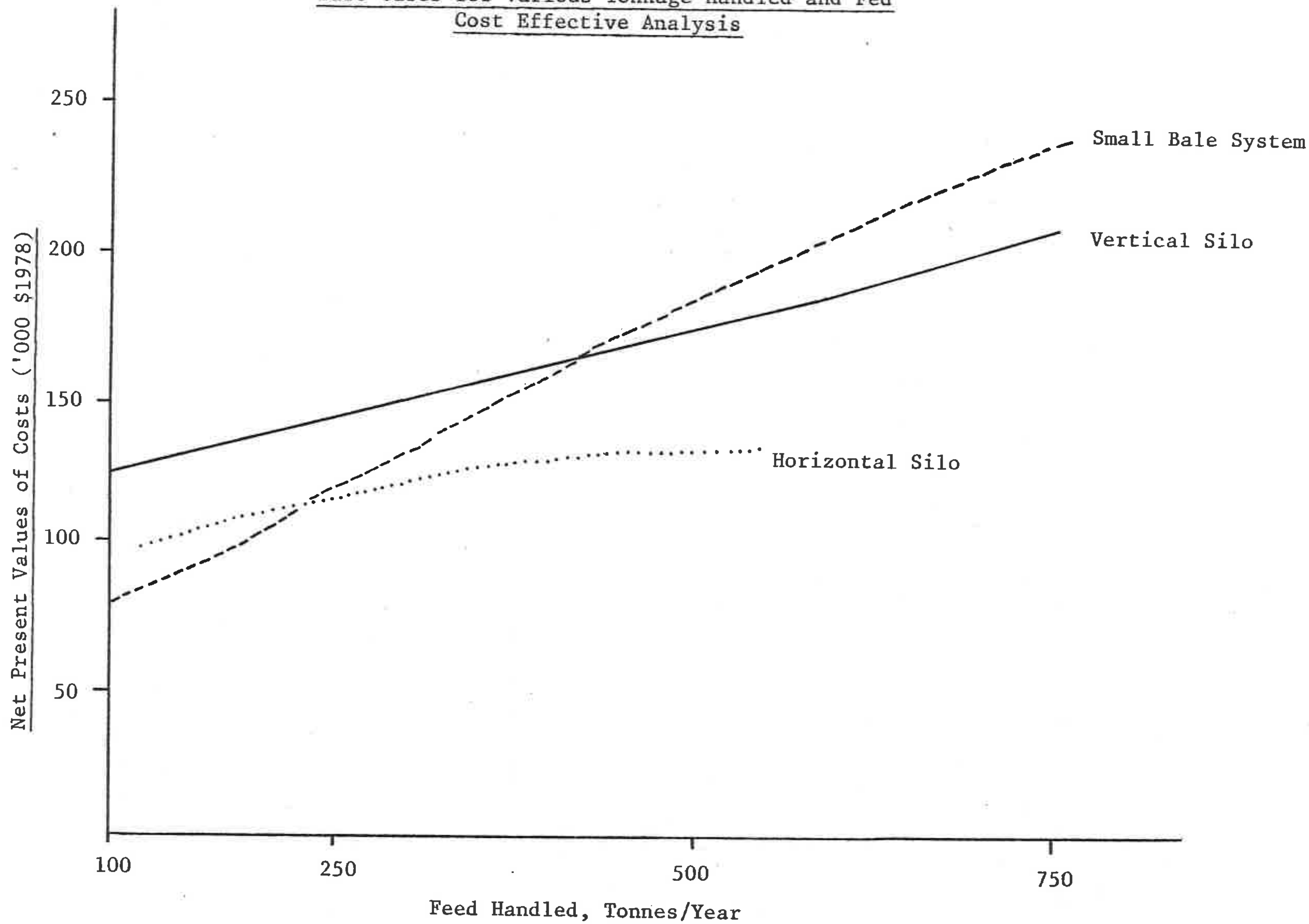
The base result is from the perspective of the individual producer. However, sufficient information is not available to gross this information up to the programme level.

3.4.2 Incrementality

The method of analyzing this project does not lend itself to assessing incrementality. However, Survey data does indicate that 67 percent of survey respondents indicated they would have undertaken the work without the incentive.

Figure 3-1

Silo Construction
Base Cases for Various Tonnage Handled and Fed
Cost Effective Analysis



3.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the private producer who actually makes the investment. The cost effective base cases are presented in Tables 3-8 to 3-11 in a cash flow format.

From a financial point of view the decision matrix is as follows:

System	Tonnes Handled and Fed			
	100	250	500	750
Vertical Silo	(\$122,280)	(\$140,390)	(\$172,140)	(\$213,460)*
Horizontal Silo	(\$ 91,660)	(\$106,720)*	(\$131,250)*	
Small Bale System	(\$ 80,080)*	(\$119,770)	(\$191,490)	(\$252,960)

Note: * asterisk denotes cost effective system for given tonnage.

These same results are presented in graphic form in Figure 3-2. The findings are similar to the economic analysis.

3.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) all provincial and federal sales and property taxes have been removed;

b) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

c) the capital grant of 50 percent of allowable capital costs has been removed from the revenue side.

The effect of these adjustments is to lower the net present value of costs in all base cases.

3.4.5 Sensitivity Analysis

To present sensitivity analysis tables for each of the base cases would be too cumbersome. However, the results of the analysis, in general terms, are that the net present value costs is sensitive to changes in the discount rate and relatively insensitive to changes in the cost of silos, both vertical and horizontal.

Table 3-8

FINANCIAL APPRAISAL OF A SMALL BALE HANDLING SYSTEM
100 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

COSTS($000)

YEAR	INVESTMENT: MACHINE& EQUIP.	OPERATING COSTS: LOADING	INSURANCE REPAIRS	HARVEST	SKILL LABOUR	UNSKILL LABOUR	OTHER	NETFLOW
1	18.08	1.46	1.17	3.43	.44	.43	0.00	-25.01
2	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
3	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
4	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
5	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
6	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
7	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
8	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
9	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
10	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
11	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.9.
12	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
13	18.08	1.46	1.17	3.43	.04	.43	-1.81	-22.80
14	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
15	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
16	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
17	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
18	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.9.
19	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94
20	0.00	1.46	1.17	3.43	.44	.43	0.00	-6.94

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -80.08

Table 3-9

FINANCIAL APPRAISAL OF FEED FACILITY INCENTIVE POLICY
HORIZONTAL SILO: 250 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

COSTS($000)

YEAR	INVESTMENT: STORAGE FEEDOUT	INVESTMENT: LOADING	OPERATING COSTS: TAXES	INSU REPAIRS	HARVEST	SILOFIL UNLOAD	SKILL LABOR	UNSKILL LABOR	SUBSIDY	OTHER	NET FLOW
1	7.92	28.18	.83	2.21	3.01	1.13	4.40	0.00	-5.38	0.00	-41.80
2	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
3	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
4	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
5	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
6	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
7	2.12	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
8	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	-.20	-9.65
9	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
10	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
11	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
12	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
13	2.12	28.18	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
14	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	-3.02	-35.02
15	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
16	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
17	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
18	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
19	2.12	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	0.00	-7.84
20	.09	0.00	.09	2.21	3.01	1.13	1.31	0.00	0.00	-.20	-9.65
										0.00	-7.84

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -106.72

Table 3-10

FINANCIAL APPRAISAL OF FEED FACILITY INCENTIVE POLICY
HORIZONTAL SILO: 500 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

COSTS($000)

YEAR	INVESTMENT		OPERATING COSTS								
	STORAGE FEEDOUT	LOADING	TAXES	INSU REPAIRS	HARVEST	SILOFIL UNLOAD	SKILL LABOR	UNSKILL LABOR	SUBSIDY	OTHER	NET FLOW
1	7.92	28.18	.83	2.21	3.87	1.97	5.71	0.00	-5.88	0.00	-44.80
2	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
3	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
4	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
5	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
6	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	-.20	-10.75
7	.21	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
8	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
9	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
10	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
11	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.0	0.00	-10.84
12	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	-.30	-[illegible].84
13	.21	28.18	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
14	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
15	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
16	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
17	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
18	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84
19	.21	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	-.20	-10.76
20	.09	0.00	.09	2.21	3.87	1.97	2.63	0.00	0.00	0.00	-10.84

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -131.25

Table 3-11

FINANCIAL APPRAISAL OF FEED FACILITY INCENTIVE POLICY
VERTICAL SILO: 750 TONNES HARVESTED AND FED

(1978 CONSTANT PRICES)
(BASE CASE)

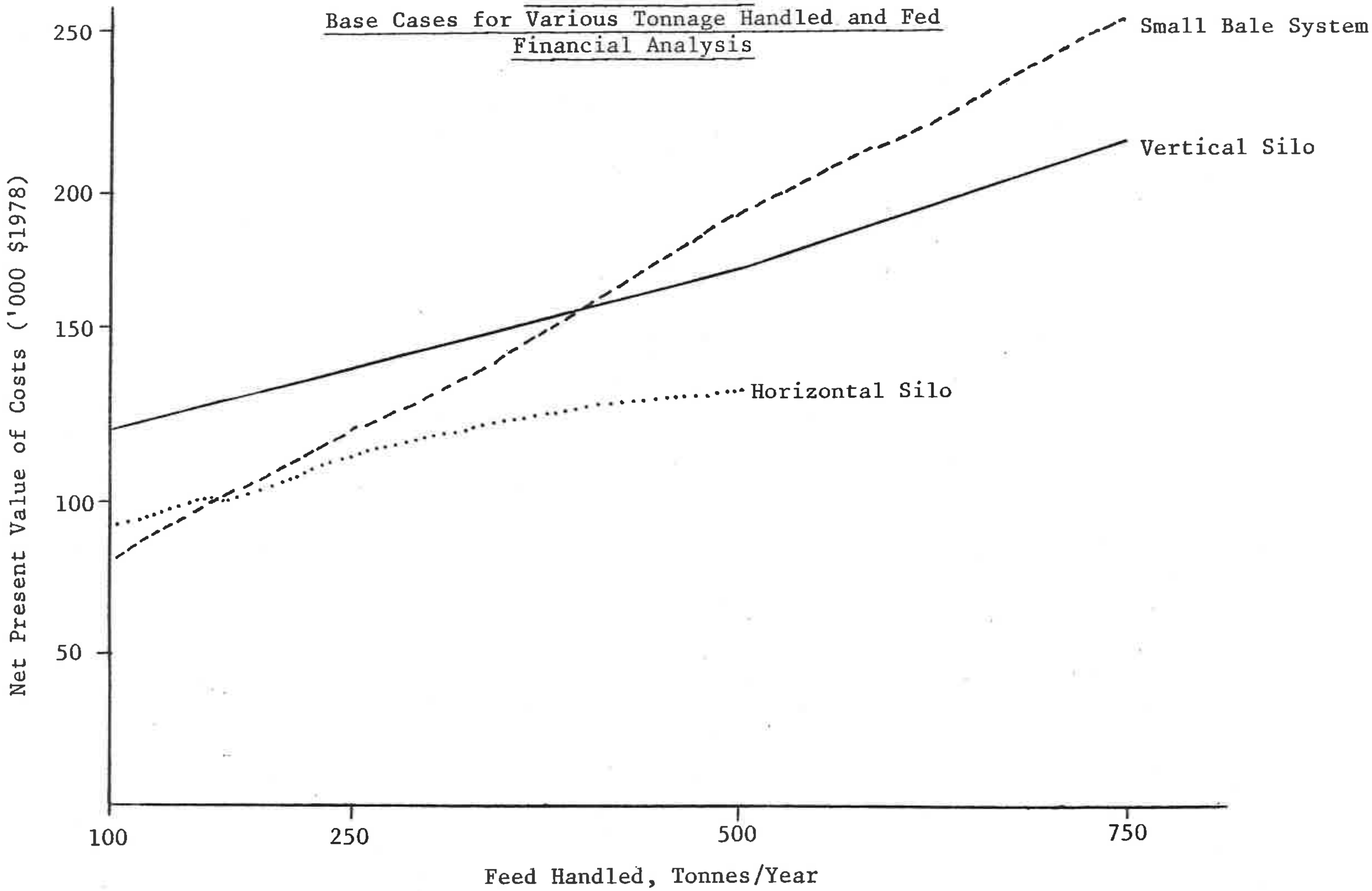
COSTS($000)

YEAR	INVESTMENT		OPERATING COSTS								
	STORAGE FEEDOUT	LOADING	TAXES	INSU REPAIRS	HARVEST	SILOFIL UNLOAD	SKILL LABOR	UNSKILL LABOR	SUBSIDY	OTHER	NET FLOW
1	31.40	32.98	2.27	3.77	4.64	4.40	10.90	.95	-6.00	0.00	-85.30
2	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	-6.00	0.00	-10.47
3	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
4	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
5	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
6	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
7	4.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	-.40	-20.06
8	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
9	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
10	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
11	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
12	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
13	17.80	32.98	.24	3.77	4.64	4.40	2.48	.95	0.00	-5.08	-62.16
14	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
15	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
16	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
17	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
18	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47
19	4.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	-.40	-20.06
20	0.00	0.00	.24	3.77	4.64	4.40	2.48	.95	0.00	0.00	-16.47

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -213.46

Figure 3-2

Silo Construction
Base Cases for Various Tonnage Handled and Fed
Financial Analysis



B. GRAIN DRYING, MILLING AND STORING

3.4.1 Cost-Benefit Analysis

This project was appraised using two cases:

i) grain drying, milling and storage unit;
ii) grain milling and storage operation.

The base case involves the handling and subsequent throughput of 5,000 bushels of grain. The costs and benefits of the two base cases are set out in cash flow form in Tables 3-12 and 3-13. The analysis indicates that the project will yield the following results:

i)	Net Present Value	($2,280)
	Benefit-Cost Ratio	.9208
ii)	Net Present Value	$6,290
	Benefit-Cost Ratio	1.3315

The base case result is on a single unit level, whether a grain drier is included or not. Survey data indicates that 295 grain drying, milling and storage units were purchased over the first four years of the programme. Furthermore, only 40 percent of survey respondents purchased grain driers. Using this information the following results for the project as a whole were obtained:

.4 x ($2,280) x 295 = ($269,040)
.6 x $6,290 x 295 = $1,113,330
Net Present Value = $844,290.

The results indicate that from the point of view of society as a whole, the programme to date has been worthwhile.

4.3.2 Incrementality

The gross net present value of $844,290 cannot be attributed exclusively to incentives provided under the programme. The Survey indicates that 67 percent of those participating would have undertaken the work without assis-

Table 3-12

ECONOMIC APPRAISAL OF A 5000 BUSHEL GRAIN STORAGE, DRYING AND MILLING OPERATION
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)					BENEFITS($000)		TOTALS($000)		
	INVESTMENT	OPERATING COSTS								
		ENERGY	LABOR SKILLED	INSURAN REPAIRS	SUBSIDY	SAVINGS	OTHER	COST	BENEFIT	NETFLOW
1	14.92	.17	.30	1.02	0.00	3.09	0.00	16.41	3.09	-13.32
2	0.00	.17	.30	1.02	0.00	3.09	0.00	1.49	3.09	1.60
3	0.00	.17	.30	1.02	0.00	3.09	0.00	1.49	3.09	1.60
4	0.00	.17	.30	1.02	0.00	3.09	0.00	1.49	3.09	1.60
5	0.00	.17	.30	1.02	0.00	3.09	0.00	1.49	3.09	1.60
6	0.00	.17	.30	1.02	0.00	3.09	0.00	1.49	3.09	1.60
7	0.00	.17	.30	1.02	0.00	3.09	0.00	1.49	3.09	1.60
8	0.00	.17	.30	1.02	0.00	3.09	0.00	1.49	3.09	1.60
9	0.00	.17	.36	1.02	0.00	3.09	0.00	1.54	3.09	1.55
10	0.00	.17	.38	1.02	0.00	3.09	0.00	1.57	3.09	1.52
11	0.00	.17	.41	1.02	0.00	3.09	0.00	1.60	3.09	1.50
12	0.00	.17	.43	1.02	0.00	3.09	0.00	1.62	3.09	1.47
13	7.52	.17	.46	1.02	0.00	3.09	.75	9.16	3.84	-5.32
14	0.00	.17	.46	1.02	0.00	3.09	0.00	1.65	3.09	1.45
15	0.00	.17	.46	1.02	0.00	3.09	0.00	1.65	3.09	1.45
16	0.00	.17	.46	1.02	0.00	3.09	0.00	1.65	3.09	1.45
17	0.00	.17	.46	1.02	0.00	3.09	0.00	1.65	3.09	1.45
18	0.00	.17	.46	1.02	0.00	3.09	0.00	1.65	3.09	1.45
19	0.00	.17	.46	1.02	0.00	3.09	0.00	1.65	3.09	1.45
20	0.00	.17	.46	1.02	0.00	3.09	0.00	1.65	3.09	1.45

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -2.28

<u>Table 3-13</u>

ECONOMIC APPRAISAL OF A 5000 BUSHEL GRAIN STORAGE, AND MILLING OPERATION
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)					BENEFITS($000)		TOTALS($000)		
	INVESTMENT	OPERATING COSTS								
		ENERGY	LABOR SKILLED	INSURAN REPAIRS	SUBSIDY	SAVINGS	OTHER	COST	BENEFIT	NETFLOW
1	9.86	.04	.25	.70	0.00	2.95	0.00	10.85	2.95	-7.90
2	0.00	.04	.25	.70	0.00	2.95	0.00	1.00	2.95	1.95
3	0.00	.04	.25	.70	0.00	2.95	0.00	1.00	2.95	1.95
4	0.00	.04	.25	.70	0.00	2.95	0.00	1.00	2.95	1.95
5	0.00	.04	.25	.70	0.00	2.95	0.00	1.00	2.95	1.95
6	0.00	.04	.25	.70	0.00	2.95	0.00	1.00	2.95	1.95
7	0.00	.04	.25	.70	0.00	2.95	0.00	1.00	2.95	1.95
8	0.00	.04	.25	.70	0.00	2.95	0.00	1.00	2.95	1.95
9	0.00	.04	.29	.70	0.00	2.95	0.00	1.04	2.95	1.91
10	0.00	.04	.31	.70	0.00	2.95	0.00	1.06	2.95	1.89
11	0.00	.04	.33	.70	0.00	2.95	0.00	1.08	2.95	1.87
12	0.00	.04	.35	.70	0.00	2.95	0.00	1.10	2.95	1.85
13	4.13	.04	.38	.70	0.00	2.95	.41	5.25	3.36	-1.89
14	0.00	.04	.38	.70	0.00	2.95	0.00	1.12	2.95	1.83
15	0.00	.04	.38	.70	0.00	2.95	0.00	1.12	2.95	1.83
16	0.00	.04	.38	.70	0.00	2.95	0.00	1.12	2.95	1.83
17	0.00	.04	.38	.70	0.00	2.95	0.00	1.12	2.95	1.83
18	0.00	.04	.38	.70	0.00	2.95	0.00	1.12	2.95	1.83
19	0.00	.04	.38	.70	0.00	2.95	0.00	1.12	2.95	1.83
20	0.00	.04	.38	.70	0.00	2.95	0.00	1.12	2.95	1.83

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 6.29

tance. The implication of this finding is that the programme in fact contributed directly to the initiation of 98 of these on-farm feed facilities. These would generate a NPV of $278,615.70.

3.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the private producer who actually makes the investment. The results using this approach are set out in Table 3-14 and 3-15. The results are as follows:

i)	Net Present Value	$3,030
	Benefit-Cost Ratio	1.10
ii)	Net Present Value	$9,660
	Benefit-Cost Ratio	1.48

3.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

b) the capital grant subsidy on capital acquisitions was dropped from the revenue side.

The effect of these adjustments is as follows:

i) lower the net present value from $3,030 to ($2,280);

ii) lower the net present value from $9,660 to $6,290.

3.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Tables 3-16 and 3-17 As indicated the net present value is sensitive to changes in the discount rate.

Table 3-14

Financial Appraisal of a 5000 Bushel Grain Storage, Drying and Milling Operation
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)					BENEFITS($000)		TOTALS($000)		
	INVESTMENT	OPERATING COSTS								
		ENERGY	LABOR SKILLED	INSURAN REPAIRS	SUBSIDY	SAVINGS	OTHER	COST	BENEFIT	NETFLOW
1	14.92	.17	.51	1.02	6.00	3.09	0.00	16.61	9.09	-7.52
2	0.00	.17	.51	1.02	1.46	3.09	0.00	1.70	4.55	2.86
3	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
4	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
5	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
6	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
7	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
8	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
9	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
10	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
11	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
12	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
13	7.52	.17	.51	1.02	0.00	3.09	.75	9.21	3.84	-5.37
14	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
15	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
16	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
17	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
18	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
19	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40
20	0.00	.17	.51	1.02	0.00	3.09	0.00	1.70	3.09	1.40

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 3.03

Table 3-15

FINANCIAL APPRAISAL OF A 5000 BUSHEL GRAIN STORAGE, AND MILLING OPERATION
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)				BENEFITS($000)			TOTALS($000)		
	INVESTMENT	OPERATING COSTS								
		ENERGY	LABOR SKILLED	INSURAN REPAIRS	SUBSIDY	SAVINGS	OTHER	COST	BENEFIT	NETFLOW
1	9.86	.04	.42	.70	4.93	2.95	0.00	11.02	7.88	-3.14
2	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
3	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
4	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
5	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
6	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
7	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
8	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
9	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
10	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
11	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
12	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
13	4.13	.04	.42	.70	0.00	2.95	.41	5.29	3.36	-1.93
14	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
15	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
16	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
17	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
18	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
19	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79
20	0.00	.04	.42	.70	0.00	2.95	0.00	1.16	2.95	1.79

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 9.66

Table 3-16

Sensitivity Analysis
Grain Drying, Milling and Storage Unit
(NPV in '000 $1978)

Variables		Benefit-Cost Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			1.39	(2.28)	(4.26)		
	BCR			1.04	.92	.82		

Variables		Financial Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			6.65	3.03	.99		
	BCR			1.17	1.10	1.04		

Note: Figures in brackets denote negative values.

Table 3- 17

Sensitivity Analysis
Grain Milling and Storage Operation
(NPV in '000 $1978)

Variables		Benefit-Cost Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			12.38	6.29	2.89		
	BCR			1.50	1.33	1.18		

Variables		Financial Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			15.61	9.66	6.30		
	BCR			1.60	1.48	1.38		

C. HAY DRIERS

3.4.1 Cost-Benefit Analysis

The costs and benefits of the hay drier for 100 acres of tame hay are set out in cash flow form in Table 3-18. The analysis indicates that the project will yield the following results:

Net Present Value	$27,020
Benefit-Cost Ratio	6.447

The base case result is for a single hay drier. Over the first four years of the programme 141 hay driers were purchased. The programme, as a whole, accordingly will yield the following results:

Net Present Value	$3,809,820
Benefit-Cost Ratio	6.447

The results indicate that from the perspective of society as a whole, the programme to date has been worthwhile. In the case of this project, and the others in the programme, it is not possible to compare NPV's and BCR's across projects. Difference in the scale of project and assumptions concerning costs and benefits make comparisons of this type untenable.

3.4.2 Incrementality

The gross net present value of $3,809,820 cannot be solely attributed to incentives provided under the programme. Although not referring specifically to hay driers the Survey indicated that 67 percent of those participating in the Feed Facility Incentive would have done the work anyway. The implication of this finding is that the incentive contributed directly to the purchase of 47 hay driers. These would generate a NPV of $1,269,940.

3.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the private producer who actually invests in the hay drier. The results using this

Table 3-18

ECONOMIC APPRAISAL OF A HAY DRIER: 100 ACRES TAME HAY
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)			BENEFITS($000)			TOTALS($000)	
	INVESTMENT	OPERATING COSTS						
YEAR	CONSTRUCTION	ELECTRICITY	INSURANCE REPAIRS	SUBSIDY	DIFFERENCE	OTHER	COST	BENEFIT	NET FLOW
1	3.32	.07	.10	0.00	3.75	0.00	3.48	3.75	.27
2	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
3	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
4	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
5	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
6	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
7	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
8	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
9	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
10	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
11	1.50	.07	.10	0.00	3.75	.15	1.67	3.90	2.23
12	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
13	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
14	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
15	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
16	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
17	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
18	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
19	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
20	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 27.02

Table 3-19

FINANCIAL APPRAISAL OF A HAY DRIER: 100 ACRES TAME HAY
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)			BENEFITS($000)			TOTALS($000)		
	INVESTMENT	OPERATING COSTS							
YEAR	CONSTRUCTION	ELECTRICITY	INSURANCE REPAIRS	SUBSIDY	DIFFERENCE	OTHER	COST	BENEFIT	NET FLOW
1	3.90	.07	.10	1.95	3.75	0.00	4.07	5.70	1.63
2	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
3	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
4	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
5	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
6	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
7	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
8	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
9	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
10	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
11	1.50	.07	.10	0.00	3.75	.15	1.67	3.90	2.23
12	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
13	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
14	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
15	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
16	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
17	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
18	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
19	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58
20	0.00	.07	.10	0.00	3.75	0.00	.17	3.75	3.58

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 28.26

approach are set out in Table 3-19. The base case project would generate a NPV of $28,260.

3.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) all provincial and federal sales taxes have been removed;

b) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

c) the capital grant of 50% of allowable capital costs has been removed from the revenue side.

The effect of these adjustments was to reduce the net present value of the project from $28,260 to $27,020.

3.4.5 Sensitivity Analysis

The results of the sensitivity analysis are presented in Table 3-20. The base case is quite sensitive to changes in the discount rate.

Table 3-20

Sensitivity Analysis
Feed Facility Incentive: Hay Drier (100 acres hay)
(NPV in '000 $1978)

Variable		Cost-Benefit Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			40.71	27.02	19.25		
	BCR			7.66	6.45	5.53		

Variable		Financial Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			42.01	28.26	20.44		
	BCR			7.30	6.18	5.30		

4.0 Central Grain Storage Unit

4.1 Sector Profile

An outline of trends in grain production in Nova Scotia was set out in Section 2.1. As noted there and in Section 3.1, due to declining total production of grains in the Province and increased dependence on imports (in absolute and relative terms), there was little pressure to expand commercial and on-farm grain processing facilities. Although there is little hard evidence to support the claim, it has been suggested that the lack of adequate cleaning and drying facilities has in itself been a factor inhibiting the expansion of grain production in the Province.

4.2 Project Description

4.2.1 Objectives

The land clearing and crop incentive programmes outlined in Sections 1 and 2 were intended to lead to an expansion of grain production in the Province. Grain drying, storage and handling facilities in existence or planned at the time of these programmes' inception lacked the capacity necessary to accommodate the anticipated increase in output of 1.8 million bushels by 1981. The Central Grain Storage Unit was designed to provide drying, storage and handling capacity for part of this increased production. Additional requirements were expected to be met by on-farm feed facilities (see Section 3) and through an expansion of commercial operations. The storage unit was to be strategically located with respect to areas of production and consumption so as to minimize transportation costs. Moreover, those responsible for design and implementation of the project were faced with the additional constraints of not inhibiting expansion under the feed facilities incentive programme and not providing subsidized competition for commercial operations.

4.2.2 Project Performance

A single grain storage unit was constructed under this programme (Schedule "A" of the Subsidiary Agreement refers to a number of facilities to be phased in to meet production requirements) and is located in Steam Mill, just outside Kentville in Kings County.

The total cost of this project was estimated at $1 million with costs shared on the basis of 80 percent by DREE and 20 percent by Nova Scotia. Table 4-1 provides a comparison of estimated and actual project cash flows. The difference between actual and projected capital costs was due primarily to faulty design of certain equipment and the bankruptcy of one of the principal suppliers of equipment. Despite these problems the project was completed on schedule and began operation in July, 1978.

Table 4-1

Central Grain Storage Unit
Projected vs. Actual Cash Flow

Year	Projected[1] $	Actual[2] $
1976-88	200,000	25,703
1977-78	300,000	837,685
1978-79	300,000	213,878
1979-80	200,000	68,162[3]
Total	1,000,000	1,145,429

Source: 1. DREE Project Brief
2. Department of Agriculture and Marketing, Province of Nova Scotia
3. This figure represents a holdback on the construction contract. The work was actually performed in 1978.

The Central Grain Storage Unit has a storage capacity of 2,500 tonnes and a maximum throughput capacity (cleaning and drying) of approximately 3,500 tonnes per month. In its first year of operation the Unit handled 9,870 tonnes of grain, although much of this was imported grain which required transfer from rail car to trucks only and no processing. During 1979, the Unit's first full year of operation, 13,800 tonnes were handled. Of this, 4,617 tonnes were local production which required cleaning and drying. The remaining two-thirds was imported grain which required minimal handling.

Upon receipt, grain is tested to determine moisture content, grade and percent dockage (foreign matter content). Special equipment to test for protein content was introduced in 1980 which will permit a further refinement of the grading process. According to policy, when the system is sufficiently fine tuned, payment will be made of the basis of protein content in addition to the factors outlined above.

The tariffs for storage, cleaning and drying services are set on a per tonne basis and vary from grain to grain. In the first year of operation charges were set equal to those prevailing in Ontario at similar operations. Prices have since been increased to reflect local operating and market conditions. Charges were increased by 15 percent in 1980 and will undergo a further 10 percent increase in 1981.

4.2.3 Operating Costs and Revenues

Financial information is available for fiscal years 1978 and 1979 although only for the latter is there a detailed breakdown of costs. Table 4-2 presents revenues and expenses for the first two years of operation. The magnitude of operating costs for the first year ($168,000) is overstated by several thousand dollars, although an accurate figure is not available. According to information received from the Auditor General's office this figure represents all of the expenses of both the Grain Centre and the Grains Commission for the first year of operation.

Table 4-2

Central Grain Storage Unit
Revenues and Operating Expenses
Fiscal Years 1978-79 and 1979-80

	1978-79	1979-80
Revenues	$35,185	$85,929
Operating Expenses		
Salaries	-	53,519
Insurance	-	14,186
Equipment and machinery	-	35,418
Electricity	-	7,533
Fuel	-	19,667
Trucking	-	2,589
Other	-	2,427
TOTAL	168,966[1]	135,339
Operating Loss	133,781	49,410

Source: Office of the Auditor General.

Note:

1. Information from the Auditor General's Department indicates that this figure overstates the actual operating costs of the Grain Storage Unit in its first year. Costs which should have been allocated to the Grains Commission have been erroneously included. Information was not available regarding the basis upon which this cost should be divided between the operations.

In its first full year of operation the Grain Storage Unit had an operating deficit of $49,410. This was due primarily to two factors:

a) with a throughput of only 4,617 tonnes, the unit on a seasonal basis (i.e. based on an operating year of four months, July, August, September and October) operated at just over 25 percent capacity.

   The increase in grain production under the ADA Programmes upon which demand for the Unit's services was predicated has not yet materialized.

b) the Unit had not been in operation long enough to develop a cost-based tariff structure. As explained earlier, these adjustments are being made.

4.3 Methodology

4.3.1 Methodological Issues

In general, the method used in the Cost-Benefit Analysis of the Central Grain Storage Unit conforms to the conventional approach set out in Chapter Two. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the operation of the facility over the twenty year evaluation period.

4.3.2 Assumptions

The following assumptions were made in carrying out the Cost- Benefit Analysis:

a) Prices: that the prices for all project inputs and outputs will not change in relative terms over the evaluation period. Costs and Revenues are expressed in constant 1978 dollars.

b) Land: that the market for land in the Kentville area is competitive and reflects opportunity costs.

c) Permanent Labour: that the permanent labour force now employed at the facility will not change in size over the evaluation period.

d) Casual Labour: that the casual labour force required to operate the plant will grow from the present three man years (six persons at peak periods) to five man years when the plant reaches full capacity.

e) Capacity Utilization: that the facility will reach full capacity of approximately 14,500 tonnes throughput of local grains (3,500 tonnes per month for peak months August, September, October and November) by 1986; that throughput of imported grain will remain constant at approximately 9,000 tonnes per year; and, that custom operations will decline with increased throughput of local grains.

f) Variable Costs for principal inputs are as follows:

	Small Grains $/tonne	Corn $/tonne
Propane	2.07	6.65
Electricity	.96	1.50

The wage rate for casual labour is \$4.50/hr. Maintenance costs have been estimated at approximately \$32,000 per year which is expected to rise to \$45,000 per year by the fifteenth year of operation.

g) Revenue: there are three principal sources of revenue: from cleaning, drying and handling local grains, from handling imported grains and from custom work. These have been estimated as follows:

Local Grains:	Winter Wheat and Rye	\$ 9.85/tonne
	Barley, Oats and Spring Wheat	6.99/tonne
	Corn	15.47/tonne
Imports:	various grains	2.20/tonne
Custom:	\$10,000 in 1979. It has been assumed that this will decline to zero by 1987 as the full capacity of the facility will be devoted to local grains.	

It is estimated that total revenue will increase from \$77,400 (1978 dollars) in 1979 to \$215,000 by 1986 and remain constant thereafter as the plant reaches full capacity.

4.4 Results

4.4.1 Cost-Benefit Analysis

The costs and benefits associated with the base case Central Grain Storage Unit are set out in cash flow form in Table 4-3. The analysis indicates that the Project will yield the following results:

Net Present Value	(869,300)
Benefit-Cost Ratio	.54

The analysis indicates that the project is not a sound one in economic terms. This is attributable to the short growing season which will limit the capacity utilization of the facility on an annual basis to approximately 25 percent. As a result the Unit will not recover its investment costs. The analysis does indicate, however, that with increasing throughput of local grains, by the third full year of operations revenues generated will exceed operating expenses.

4.4.2 Financial Analysis

In the financial analysis the facility has been treated as a commercial operation viewed from a private perspective. The results using this approach are set out in Table 4-4 .

The base case project would generate a negative net present value of $1,110,220.

4.4.3 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie these analytical frameworks have been explained in detail in Chapter Two. The adjustements made to the financial variables in order to present the information in an economic context are as follows:

Table 4-3

ECONOMIC APPRAISAL OF CENTRAL GRAIN STORAGE UNIT: STEAM MILL
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)									BENEFITS($000)	TOTALS($000)		
	INVESTMENT		OPERATING COSTS										
YEAR	LAND	CONSTRUCTION	PERM. LABOR	CASUAL LABOR	FUEL	ELECTRICITY	MAINTENANCE	INSURANCE	OTHER	SALES	COST	BENEFIT	NETFLOW
1	3.66	23.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.13	0.00	-27.13
2	0.00	776.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	776.09	0.00	-776.09
3	0.00	289.14	0.00	0.00	0.00	0.00	0.00	0.00	168.97	35.19	458.11	35.19	-422.92
4	0.00	0.00	14.74	14.19	17.72	6.79	31.91	12.78	6.50	77.42	104.63	77.42	-27.21
5	0.00	0.00	14.74	16.35	19.76	8.42	31.91	12.78	6.54	104.46	110.50	104.46	-6.04
6	0.00	0.00	14.74	17.48	21.71	9.27	31.91	12.78	6.58	123.48	114.48	123.48	9.00
7	0.00	0.00	14.74	18.84	24.06	10.30	31.91	12.78	6.62	130.59	119.25	130.59	11.34
8	0.00	0.00	14.74	20.47	26.88	11.53	31.91	12.78	6.66	149.72	124.97	149.72	24.76
9	0.00	0.00	17.20	26.16	30.26	13.01	31.91	12.78	6.70	167.52	138.02	167.52	29.51
10	0.00	0.00	18.43	30.97	34.31	14.78	33.80	12.78	6.75	199.19	151.82	199.19	37.37
11	0.00	0.00	19.66	36.31	38.57	16.64	35.79	12.78	6.80	215.02	166.54	215.02	48.48
12	0.00	0.00	20.88	38.58	38.57	16.64	37.90	12.78	6.80	215.02	172.15	215.02	42.87
13	0.00	0.00	22.11	40.85	38.57	16.64	40.14	12.78	6.80	215.02	177.89	215.02	37.13
14	0.00	0.00	22.11	40.85	38.57	16.64	42.50	12.78	6.80	215.02	180.25	215.02	34.77
15	0.00	0.00	22.11	40.85	38.57	16.64	45.05	12.78	6.80	215.02	182.80	215.02	32.22
16	0.00	0.00	22.11	40.85	38.57	16.64	45.05	12.78	6.80	215.02	182.80	215.02	32.22
17	0.00	0.00	22.11	40.85	38.57	16.64	45.05	12.78	6.80	215.02	182.80	215.02	32.22
18	0.00	0.00	22.11	40.85	38.57	16.64	45.05	12.78	6.80	215.02	182.80	215.02	32.22
19	0.00	0.00	22.11	40.85	38.57	16.64	45.05	12.78	6.80	215.02	182.80	215.02	32.22
20	0.00	0.00	22.11	40.85	38.57	16.64	45.05	12.78	6.80	215.02	182.80	215.02	32.22

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -869.26

Table 4-4

FINANCIAL APPRAISAL OF CENTRAL GRAIN STORAGE UNIT: STEAM MILL
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)									BENEFITS($000)	TOTALS($000)		
	INVESTMENT		OPERATING COSTS										
YEAR	LAND	CONSTRUCTION	PERM. LABOR	CASUAL LABOR	FUEL	ELECTRICITY	MAINTENANCE	INSURANCE	OTHER	SALES	COST	BENEFIT	NETFLOW
1	3.66	29.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.06	0.00	-33.06
2	0.00	896.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	896.32	0.00	-896.32
3	0.00	282.04	0.00	0.00	0.00	0.00	0.00	0.00	168.97	35.19	451.01	35.19	-415.82
4	0.00	68.16	24.57	23.65	17.72	6.79	31.91	12.78	6.50	77.42	192.08	77.42	-114.66
5	0.00	0.00	24.57	27.25	19.76	8.42	31.91	12.78	6.54	104.46	131.22	104.46	-26.77
6	0.00	0.00	24.57	29.13	21.71	9.27	31.91	12.78	6.58	123.48	135.96	123.48	-12.48
7	0.00	0.00	24.57	31.40	24.06	10.30	31.91	12.78	6.62	130.59	141.64	130.59	-11.05
8	0.00	0.00	24.57	34.12	26.88	11.53	31.91	12.78	6.66	149.72	148.44	149.72	1.28
9	0.00	0.00	24.57	37.38	30.26	13.01	31.91	12.78	6.70	167.52	156.60	167.52	10.93
10	0.00	0.00	24.57	41.29	34.31	14.73	33.80	12.78	6.75	189.19	168.28	189.19	20.90
11	0.00	0.00	24.57	45.39	38.57	16.64	35.79	12.78	6.80	215.02	180.54	215.02	34.48
12	0.00	0.00	24.57	45.39	38.57	16.64	37.90	12.78	6.80	215.02	182.65	215.02	32.37
13	0.00	0.00	24.57	45.39	38.57	16.64	40.14	12.78	6.80	215.02	184.89	215.02	30.13
14	0.00	0.00	24.57	45.39	38.57	16.64	42.50	12.78	6.80	215.02	187.25	215.02	27.77
15	0.00	0.00	24.57	45.39	38.57	16.64	45.05	12.78	6.80	215.02	189.80	215.02	25.22
16	0.00	0.00	24.57	45.39	38.57	16.64	45.05	12.78	6.80	215.02	189.80	215.02	25.22
17	0.00	0.00	24.57	45.39	38.57	16.64	45.05	12.78	6.80	215.02	189.80	215.02	25.22
18	0.00	0.00	24.57	45.39	38.57	16.64	45.05	12.78	6.80	215.02	189.80	215.02	25.22
19	0.00	0.00	24.57	45.39	38.57	16.64	45.05	12.78	6.80	215.02	189.80	215.02	25.22
20	0.00	0.00	24.57	45.39	38.57	16.64	45.05	12.78	6.80	215.02	189.80	215.02	25.22

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -1110.22

a) all federal and provincial sales taxes on construction materials have been removed. A rate of 15 percent was used to make this adjustment.

b) labour costs incurred during construction were reduced by the shadow wage rate factor set out in Chapter Two. This did not result in a significant change in construction costs due to the capital intensiveness of the facility.

c) labour costs during operation have been reduced by the shadow factors set out in Chapter Two. A comparison of the labour component in Tables 4-3 and 4-4 shows that this adjustment does have a substantial impact on net flows.

4.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Table 4-5. As the figures indicate, the base case net present value is insensitive to changes in any of the key operating expenses or the discount rate. This is the case because of the overwhelming effect of capital costs on the discounted cash flow.

Table 4-5

Sensitivity Analysis
Central Grain Storage Unit
(NPV in '000 $1978)

Variables		Cost-Benefti Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			(876.7)	(869.3)	(826.6)		
	BCR			.66	.54	.43		
Construction	NPV	(737.3)	(781.3)	(825.3)	(869.3)	(913.3)	(957.3)	(1001.3)
	BCR	.58	.56	.55	.54	.52	.51	.50
Casual Labour	NPV	(844.3)	(852.6)	(860.9)	(869.3)	(877.6)	(885.9)	(894.2)
	BCR	.54	.54	.54	.54	.53	.53	.53
Fuel	NPV	(842.4)	(851.9)	(860.3)	(869.3)	(878.2)	(887.2)	(869.1)
	BCR	.54	.54	.54	.54	.53	.53	.53
Revenue	NPV	(1019.9)	(969.7)	(919.5)	(869.3)	(819.1)	(768.9)	(718.6)
	BCR	.46	.48	.51	.54	.56	.59	.62

Variables		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			(1182.6)	(1110.2)	(1023.9)		
	BCR			.59	.47	.38		
Construction	NPV	(956.3)	(1007.6)	(1058.9)	(1110.2)	(1161.5)	(1212.8)	(1264.1)
	BCR	.51	.50	.49	.47	.46	.45	.44
Casual Labour	NPV	(1077.1)	(1088.1)	(1099.2)	(1110.2)	(1121.3)	(1132.3)	(1143.4)
	BCR	.48	.48	.48	.47	.47	.47	.47
Fuel	NPV	(1083.4)	(1092.3)	(1101.3)	(1110.2)	(1119.2)	(1128.1)	(1137.1)
	BCR	.48	.48	.48	.47	.47	.47	.47
Revenue	NPV	(1260.8)	(1210.6)	(1160.4)	(1110.2)	(1061.0)	(1009.8)	(959.6)
	BCR	.40	.42	.45	.47	.50	.52	.55

Note: Figures in brackets denote negative values.

III. LIVESTOCK DEVELOPMENT

5.0 Beef Production Incentive

5.1 Sector Profile

The beef industry in Nova Scotia underwent considerable expansion and some structural change in the twenty-five years leading to inception of the ADA Incentive Programme. As Table 5-1 indicates, between 1953 and 1975, the size of the stock of breeding females grew from 7,500 to 27,000 animals.* This growth was paralleled by a decline in the number of dairy cows (from 82,000 to 40,000) as both types of operations became more specialized and the dual purpose herd became less common.

Table 5-1

Cows and Heifers Two Years and Over
1953 - 1975

Year	For Milk	For Beef
1975	40,000	27,000
1970	43,000	20,800
1965	55,000	18,200
1960	66,000	12,000
1955	82,500	12,000
1953	82,000	7,500

Source: Department of Agriculture and Marketing, Agricultural Statistics 1978, Table 16.

Despite its growth, the beef industry in general in Nova Scotia remains highly fragmented. On most farms, beef production is but one aspect of a mixed operation. This heterogeneity of operations makes difficult a meaningful breakdown of producers into conventional categories such as cow-calf or feeder enter-

* Although not in place until 1976, the ADA Incentive Programme was preceded for two years (1974-1975) by a Provincially-funded Beef Production Policy which offered grants identical to those of the ADA Programme. As Table 5-4 shows, grants were provided for 7,491 females during 1974-75.

prises. As reported in the Nova Scotia Beef Survey carried out in early 1978, only 14 percent of the 3,292 farms producing beef in the Province cited beef production as the major source of income. Over 64 percent of producers reported fewer than 14 animals, as indicated in Table 5-2. Of all farms reporting, 86.5 percent marketed fewer than 15 animals in 1977.

Table 5-2

Categories of Beef Farms by
Number of Animals and Number Marketed
1977

Number of Animals	Farms Reporting		Farms Marketing	
	Number	Percent	Number	Percent
0-14	2,150	65.3	2,849	86.5
15-20	321	9.8	179	5.4
21-30	292	8.9	118	3.6
31-40	171	5.2	61	1.9
41-50	102	3.1	25	.8
51-100	192	5.8	46	1.5
101-150	34	1.1	7	.2
151 and over	30	.8	7	.2
TOTAL	3,292	100.0	3,292	100.0

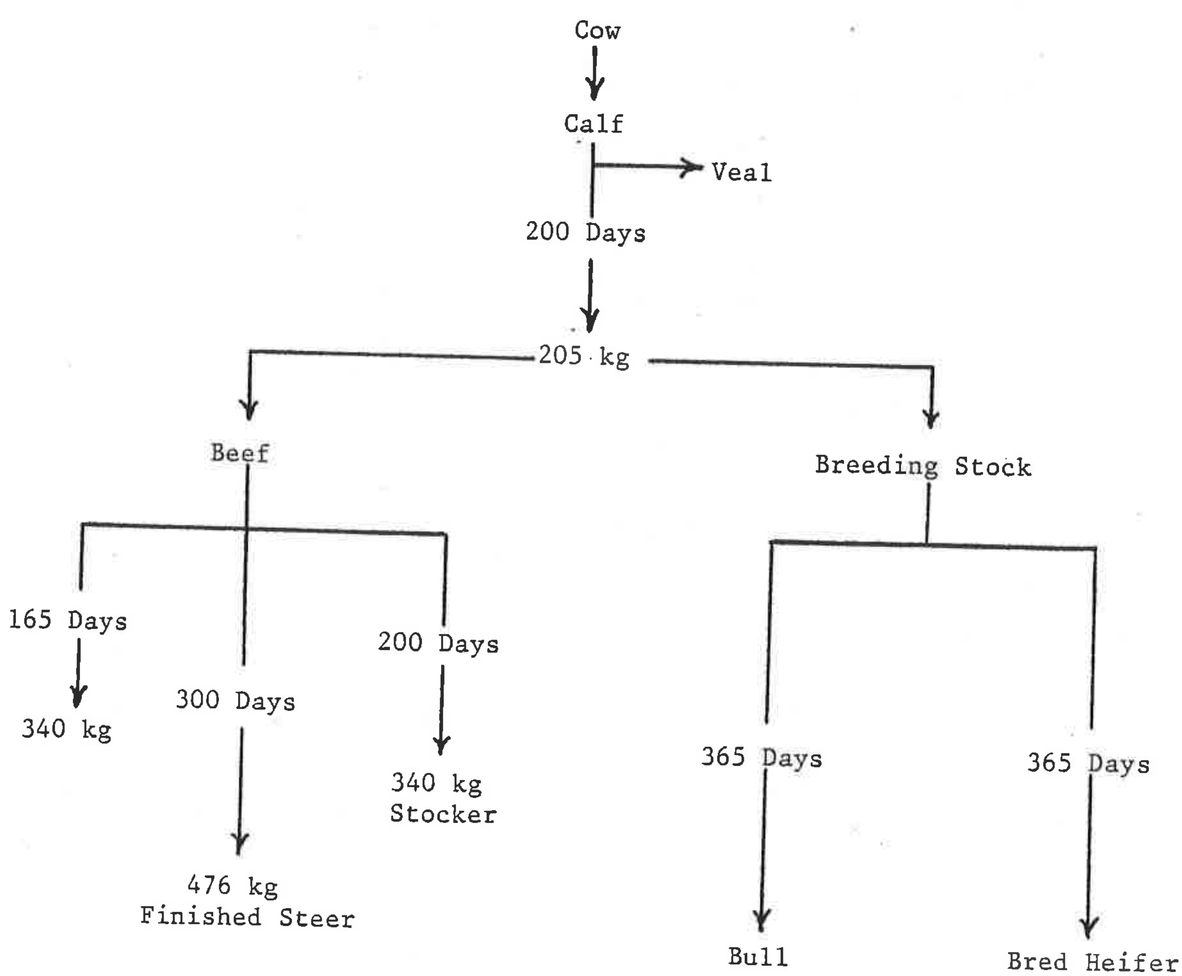
Source: Department of Agriculture and Marketing, Nova Scotia Beef Survey, 1978, Tables VI(A) and VII(A).

A heifer will reach breeding age at two years and will normally produce one calf per year. The average breeding life of a cow is five years. Although there is considerable variation in the time of year that heifers are bred, most producers aim for a late winter or early spring calving so that calves are ready for fall marketing. Spring calves offer the advantage of costing less to produce in terms of feed and labour costs. The calf will vary in weight from 300 to 600 pounds when weaned depending on calving date and feeding level. The average weaning weight in Nova Scotia is 465 pounds although there is some variation between heifers and steers. The feeding programme for beef cow herds is normally hay and silage during the winter months and pasture during summer. Since the climate is relatively mild in the Province, elaborate structures are not required for animals which are over-wintered.

The weight at which animals are marketed will depend primarily on the type of enterprise, the current and anticipated market prices for feeder calves, stockers and finished steers, and on the current and anticipated prices of feed. The range of choices which are open to a producer regarding the disposition of calves is presented in Figure 5-1.

Figure 5-1

Beef Production Alternatives



As a rule, decisions regarding calf disposition are based on annual and cyclical fluctuations of the variables mentioned above. Due to the uncertainty and instability inherent in this industry for which, by choice, no marketing organization nor price stabilization programme exists, it is extremely difficult for producers to anticipate the pattern of calf dispositions at any given point in the future. As a result of this uncertainty and due to the relatively low incomes of beef producers generally, there has been little incentive to undertake the investments in facilities and livestock necessary to expand the herd in the Province to a size at which expansion can be self-generating. Although these investments are not high in absolute terms, they do present formidable obstacles in relation to the incomes of most producers.

5.2 Project Description

5.2.1 Objectives

The general objective of the Incentive Programme is to provide financial assistance to producers to encourage expansion of the beef breeding stock. This objective is to be achieved through the payment of a fixed sum to the producer for each beef female purchased or retained for expansion purposes. This sum was set initially at \$100 per head and was increased to \$175 per head in 1979. It was anticipated that the programme would assist in expanding the beef breeding stock by 20,000 head over a five year period.

Payment of the grant was made subject to the following conditions:

a) animals must meet standards of quality and productivity;

b) producers must have a minimum of 15 females of breeding age and cannot use artificial insemination economically;

c) maximum annual expansion is limited to 50 percent of existing herd to a maximum of 50 head per year; and,

d) producers must have the resources to carry out an expansion programme aimed at developing a high quality herd.

The total estimated cost of the Programme is $2 million to be divided as follows:

Federal Share	Provincial Share
$1,600,000	$400,000

5.2.2 Programme Performance

The rate of expansion achieved under the Incentive Programme in its first four years is summarized in Table 5-3. A total of 6,780 females were either retained or purchased. As indicated in Table 5-3, 88 percent of the expansion was accounted for by females which were retained. By the end of 1979 the Programme had achieved 34 percent of its objective in terms of expansion of the breeding stock. This expansion was achieved through expenditures of 42.3 percent of the estimated five year cost. Grants were provided to 755 applicants, many of whom were repeaters. By the end of the third year of the Programme grants had been made to a net total of 427 producers. It has been estimated that over the four years there have been a net total of 450 participants.

Table 5-3

Beef Production Incentive Project
Beef Female Expansion 1976-1979

Year	Participants Number	Beef Females[1] Retention Number	%	Purchase Number	%	Grant Expenditure $
1976	236	2,257		308		256,500
1977	127	1,228		168		139,600
1978	77	516		70		58,600
1979	315	1,965		268		390,775
TOTAL	755	5,966	88	814	12	845,475

Source: Annual Reports

Notes: 1. The division between females retained and purchased has been estimated on the basis of information contained in the Survey, Table 4.19.

On the basis of the results of the Nova Scotia Beef Survey, this estimate would mean that virtually all of the 464 producers who reported beef production as the major source of farm income in 1979 have participated in the Programme.

The decline in the number of participants and grants paid from 1976 to 1977 can be accounted for by the very low price which prevailed for beef generally from 1974 through 1977. During 1978 there was a further decline in participants and grants paid due primarily to competition from a higher paying incentive scheme introduced by the Province in that year. There was a revival of interest in the ADA Incentive Programme in 1979 both because the Provincial policy was dropped (with the higher grant per head available under the ADA Programme) and due to higher beef prices.

It is difficult to assess the impact that this Programme has had on the size of the total breeding stock in Nova Scotia. One of the more difficult problems is isolating its effects from similar programmes which operated prior to its inception and concurrently with it. The problem is illustrated in Table 5-4. The key point to note is that over the period 1974-1979, there was a net increase in herd size of 3,000 females of breeding age while programmes were in place which provided incentives for the net addition of a cumulative total of 14,271 females.* Three factors can be cited to explain the relationship between the figures in Columns 2 and 3 of Table 5-4.

a) Firstly, although the programmes required that females purchased or retained be net additions, not simply replacements to the herd, unless the producer was a repeat applicant no means of enforcing the proviso existed. Consequently, in the face of the

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* The Provincial Beef Herd Development Policy which operated during 1978 only was designed to improve cow herds by providing an incentive of $175 per heifer purchased or retained as a replacement female. Incentives were provided for 22.83 calves in that year. Since these animals were not required to be net additions to the herd the cumulative total is 14,271.

Table 5-4

Impact of Beef Incentive Programmes
1974 - 1979

	Beef Females for which grant received 1	Net Additions Cumulative Total 2	Breeding Female Herd Size at June 30 3
1971	-		21,564
1972	-		22,000
1973	-		23,000
1974	7,491 (1)		24,500
1975		7,491	27,000
1976	2,565 (2)	10,056	28,200
1977	1,396 (2)	11,452	28,600
1978	2,869 (3)	12,038	27,500
1979	2,233 (4)	14,271	26,000

Source: a) Staff and Annual Reports of the Department of Agriculture and Marketing.

b) Department of Agriculture and Marketing, Agricultural Statistics 1978, Table 16.

Notes: 1) Provincial "Beef Production Policy" in effect;

2) ADA Beef Production Incentive Programme in effect;

3) Provincial, "Beef Herd Development Policy" and the ADA "Beef Production Incentive @ \$175 were provided for 2,283 replacement females under the former and @ \$100 for 586 females added under the latter. The cumulative total includes only females required to be net additions.

4) Provincial policy dropped in 1979 with funding carried on under ADA @ \$175 per female. Now referred to as "Beef Herd Improvement Policy."

1974-77 period of very low prices many producers who did not intend to participate in the future would have liquidated breeding stock.

b) Secondly, it is arguable that much of the stock liquidation which took place was done on relatively small farms which did not qualify for grants in the first place. As the Nova Scotia Beef Survey showed [Table VI(B)], over 65 percent of the farms which reported beef production in 1977 had fewer than the requisite 15 females needed to qualify for the Incentive Programme. If one makes the assumption that the average size of the breeding stock on these farms was 7 females, then this group would account for just over 50 percent of the total Provincial herd of breeding females.

c) Thirdly, and perhaps the most important point, is that although the figures in Table 5-4 seem to indicate that the Incentive Programmes undertaken during the past six years have been futile in terms of stock expansion, this has not been the case. The relevant question is what would have happened in their absence?

Table 5-5

Cows and Heifers for Beef, Two Years and Over
June/July, 1971-1980

Year	Nova Scotia		New Brunswick		Prince Edward Island	
	Number	% decrease	Number	% decrease	Number	% decrease
1971	21,564		18,000		10,000	
1972	22,000		18,000		10,000	
1973	23,000		18,000		10,000	
1974	24,500		23,000		14,000	
1975	27,000		26,000		14,000	
1976	28,200		27,000		14,000	
1977	28,600		25,000		14,000	
1978	27,500	7.8	23,200	33.3	13,000	21.0
1979	26,000		18,000		11,000	
1980	27,000		19,000		12,500	

Source: Statistics Canada and the Nova Scotia Department of Agriculture and Marketing, Agricultural Statistics 1978, Table 15.

Table 5-5 provides some indication. Once herds had reached their peak, in 1976, breeding stock in New Brunswick and Prince Edward Island went into serious decline due to low market prices. Between 1976 and 1979 the herds declined by 33.3 percent and 21 percent respectively. The decline in the Nova Scotia herd, notwithstanding the Incentive Programmes, was 7.8 percent over the same period.

To conclude, the most important effect of the Incentive Programme(s) has been to prevent a serious decline in the size of the breeding herd in Nova Scotia. The expansion target was not achieved. The question of whether the benefits of the Programme outweigh the costs is addressed in Section 5.3.

5.2.3 Participant Profile

An estimated 450 producers participated in the incentive programme over its first four years with many of these participating in more than one year. A profile of the average participant based on information contained in the Survey is presented in Table 5-6. This information covers only the first three years of the Programme and was based on a sample of 30 producers, 7 percent of the total individual participants (427) up to that point. The information reproduced here provides a rough indication only of the average operation. For a more detailed description see Sorflaten 1980.

The most significant features to note about the average participant are that:

a) the family farm is the predominant type of operation;
b) average herd size is 68.6 animals of which 31.2 are females of breeding age;
c) over half the participants had off-farm employment which averaged 178 days per year;
d) average income is relatively low with only 36 percent of participants reporting farm income exceeding $15,000;
e) the increase in beef females under the policy was 14;
f) only six of the 30 respondents reported purchases;
g) fifty-seven percent would have done the work without assistance;
h) approximately 25 percent did not plan further expansion under the policy.

Table 5-6

Profile of the Average Participant
Beef Production Incentive

Item	Number of Responses	Average Measure	Average Percentage
1. Age of Operator	30	46.5 years	-
2. Type of farm: family	29	-	96.7
partnership	1	-	3.3
3. Total land: operated	30	355.0 acres	-
for pasture or grazing	30	50.7 acres	-
4. Value of land and buildings	30	$147,933	-
5. Value of machinery and equipment	30	$38,030	-
6. Total cattle and calves	30	68.6	-
cows and heifers over 2 yrs	30	31.2	45
heifers 1-2 years	26	9.7	14
steers over 1 year	17	9.4	13
bulls over 1 year	28	1.5	2
calves under 1 year	29	22.8	32
7. Total pigs	8	27.25	-
8. Poultry: chicken	5	24.8	-
geese	4	4	-
ducks	2	8.5	-
9. Total sheep	2	3	-
10. Labour: employees	2	1.5	-
weeks paid labour	21	21.4	-
11. Off-farm work/year	16	178.75	-
12. Value of products sold:			
0-4,999	5	-	16.7
5,000-14,999	14	-	46.6
15,000-34,999	8	-	26.6
35,000 and over	3	-	10.0
13. Number of beef females before expansion	30	25	-
14. Increase in females under this policy	30	14.2	-
15. Number of females for which grant was obtained: retained	29	12.5	-
purchased	6	7.2	-
16. Average cost/animal purchased	5	462.12	-
17. Number who would have proceeded without grant	30	17	57
18. Number who plan to continue expansion under policy	30	22	73

5.3 Methodology

5.3.1 Methodological Issues

In general, the method used in the Cost-Benefit Analysis of the Beef Production Incentive Programme conforms to the conventional approach set out in Chapter Two. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the operations of all participating beef producers as though they were a single cow-calf enterprise.

In principle, projects would be analyzed for a period which conformed to the economic life of the asset under consideration. In the case of beef cows this would be approximately the 5 to 6 years of their productive lives, although market conditions might be such that the asset would have to be disposed of sometime earlier. (This was assumed not to have been necessary here.) The programme was evaluated for a 20 year period which was comprised of a simulation period of 10 years, (the period from the inception of the project in 1976, to the end of the productive life of the females added in 1979 which was assumed to be in 1985) and an evaluation period of a further 10 years when all variables were held constant. See Table 5-7 for detailed information regarding the dynamics of herd composition which formed the basis of the analysis.

5.3.2 Assumptions

The following are the key assumptions used in carrying out the Cost-Benefit Analysis of this Programme:

a) Type of Enterprise: to simplify the analysis and to isolate the effects of the programme it was assumed that all females retained or purchased were added to an established cow-calf enterprise which was devoted solely to feeder calf production.

b) Capital Investment: in the form of barn construction was estimated at \$ 274,980 (\$ 1978) phased over the four years of the programme as indicated in Table 5-7. This estimate is based on grants paid under the Provincial Capital Grants Programme. It was assumed that 25% of the investment in each year could be attributed directly to herd expansion under the incentive programme.

Table 5-7

Breeding Stock Growth and Calf Production
1976 - 1995

	Total Cows[1]	Cows of Breeding Age[1]	Females Calving[2]	Total Calves[3]	Cull Cows[4]	Cull Bulls[4]	Market Calves[5]	
							Steers	Heifers
	1	2	3	4	5	6	7	8
1976	2,565	308	-	-	-	-	-	-
1977	3,961	2,733	293	284	-	-	142	142
1978	4,547	4,031	2,596	2,518	-	-	1,259	1,259
1979	6,780	4,816	3,829	3,714	-	-	1,857	1,857
1980	6,780	6,780	4,574	4,437	-	-	2,219	2,219
1981	6,780	6,780	6,441	6,248	308	45	3,079	2,816
1982	6,780	6,780	6,441	6,248	2,425	45	3,079	699
1983	6,780	6,780	6,441	6,248	1,298	45	3,079	1,826
1984	6,780	6,780	6,441	6,248	784	45	3,079	2,340
1985	6,780	6,780	6,441	6,248	1,965	45	3,079	1,159
1986	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1987	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1988	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1989	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1990	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1991	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1992	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1993	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1994	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768
1995	6,780	6,780	6,441	6,248	1,356	45	3,079	1,768

Notes:
(1) From Table

(2) A calving rate of 95% has been assumed

(3) A mortality rate of 3% has been assumed in determining total market calves.

(4) Cows and bulls are assumed to have a productive life of five years and are marketed in the final productive year

(5) The number of calves actually marketed is reduced by the number of males and females necessary to replace culled bulls and cows.

c) Investment in Livestock: A total of 814 females were assumed purchased, the estimate based on Survey information. Average investment per female was $462 according to the Survey. A total of 5,966 females were assumed retained. Detailes are set out in Table 5-7.

d) Operating Costs: estimates were based on the Farm Management budget for a cow-calf enterprise. All amounts are expressed in 1978 dollars. The most significant expenses were:

Item	$ per cow
feed (hay and grain)	125.50
maintenance	17.50
marketing (@ 6% of calf price)	14.38
utilities	7.00
mortality	7.42
taxes	3.50
other	30.00

e) Breeding and Calf Production: the following assumptions were made:

i) 95 percent calf crop at weaning
ii) 3 percent mortality rate
iii) birth date March
iv) marketing date October
v) females first bred at 2 years of age
vi) 20 percent cull rate

The details of breeding stock growth and calf production assumed to have occurred under this programme are set out in Table 5-7.

f) Revenue: the sale of feeder calves represents the primary source of income with cull cows and bulls a secondary source. Prices for each category for the first four years were based on actual market prices received in Nova Scotia.

	Steers $/cwt	Heifers $/cwt	Cows $/cwt	Bulls $/cwt
1977	36.2	30.4	-	-
1978	80.7	70.0	45.0	45.0
1979	81.1	70.5	49.5	49.5
1980	77.4	74.5	54.0	54.0

No attempt was made to try and forecast the cyclical fluctuation in prices and consequent affect on herd size and composition over the evaluation period to the year 1995. From 1981 to the end of the forecast period an average price of $50/cwt was assumed for Steers; $40/cwt for heifers and $30/cwt for cows and bulls.

Table 5-8

Additions to Breeding Stock
Under Beef Production Policy
1976 - 1980

	Females Retained[1]	Females Purchased[1]	Females of Breeding Age[2]
1976	2,257	308	308
1977	1,228	168	2,733
1978	516	70	4,031
1979	1,965	268	4,816
1980	-	-	6,780

Source: Annual Reports

Notes:
1. The division between females retained and purchased has been estimated on the basis of information contained in the Survey, Table 4.19.
2. Females purchased are assumed to be of breeding age at the time of purchase and will calve the year after purchase. Retained heifers are assumed to calve in the second year following retention.

5.4 Results

5.4.1 Cost-Benefit Analysis

The costs and benefits associated with the base case analysis of the Beef Production Incentive Programme are set out in cash flow form in Table 5-9. The analysis indicates that the Programme will yield the following results:

Net Present Value	(1,001,520)
Benefit-Cost Ratio	.90

These results indicate that at a discount rate of 10 percent, the programme is not a sound one in economic terms. The results in this particular case, however, depend very much on the accuracy of one critical assumption, namely, the price of beef. The cyclical fluctuations in prices which have occurred historically have not been built into the analysis. From this perspective the analysis is admittedly unrealistic. To have approached the problem in a more sophisticated manner, e.g., through the use of the Agriculture Canada Commodity Forecasting Model was beyond the scope of this study.

Beef prices used in the base case analysis were set at a level which was estimated to be the minimum necessary to provide the incentive for continued production, i.e., to prevent breeding stock liquidation. They may prove to be unrealistically high or low, on average, over the forecast period. The results of the analysis should be interpreted very much in the context of the price assumption. To the extent that prices might be expected to exceed those assumed, the net present value of the programme will improve. To the extent that the price assumption is optimistic the magnitude of the negative net present value will increase. This is to be expected, since, with lower prices, there is a greater likelihood that breeding stock numbers will decline. With

Table 5-9

ECONOMIC APPRAISAL OF BEEF PRODUCTION INCENTIVE POLICY
(1978 CONSTANT PRICES)
(BASE CASE)

YEAR	COSTS($000) INVESTMENT COWS& BULLS	BARNS	OPERATING COSTS FEED	UTILI LITIES	MARKE TING	MAINTE NANCE	MORTA LITY	TAXES	OTHER	BENEFITS($000) SALES	INCEN TIVE	TOTALS($000) COST.	BENEFIT	NETFLOW
1	152.30	91.18	168.98	4.49	0.00	11.22	4.76	0.00	19.27	0.00	0.00	452.19	0.00	-452.19
2	152.62	61.37	429.98	27.73	2.57	69.32	29.39	0.00	119.03	42.86	0.00	892.00	42.86	-849.14
3	74.34	18.96	560.57	31.83	52.05	79.57	33.74	0.00	136.64	862.94	0.00	987.69	862.94	-124.75
4	146.82	64.97	746.31	47.46	76.97	118.65	50.31	0.00	203.74	1282.89	0.00	1455.23	1282.89	-172.34
5	0.00	0.00	893.43	47.46	84.74	118.65	50.31	0.00	203.74	1534.29	0.00	1398.33	1534.29	135.96
6	0.00	0.00	893.43	47.46	66.94	118.65	50.31	0.00	203.74	1328.28	0.00	1380.53	1328.28	-52.25
7	0.00	0.00	893.43	47.46	135.08	118.65	50.31	0.00	203.74	1618.31	0.00	1448.68	1618.31	169.64
8	0.00	0.00	893.43	47.46	113.80	118.65	50.31	0.00	203.74	1463.91	0.00	1427.39	1463.91	36.52
9	0.00	0.00	893.43	47.46	85.08	118.65	50.31	0.00	203.74	1393.49	0.00	1398.67	1393.49	-5.17
10	0.00	0.00	893.43	47.46	122.47	118.65	50.31	0.00	203.74	1555.29	0.00	1436.06	1555.29	119.23
11	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
12	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
13	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
14	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
15	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
16	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
17	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
18	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
19	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64
20	0.00	0.00	893.43	47.46	107.62	118.65	50.31	0.00	203.74	1471.86	0.00	1421.21	1471.86	50.64

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -1001.52

fewer females there will be lower calf production and lower net revenues to offset the investment made in the first four years of the evaluation period.

5.4.2 Incrementality

The gross net present value of (1,001,520) cannct be attributed solely to incentives provided under the Programme. The Survey indicates that 57 percent of those participating would have undertaken the work without assistance. This does not necessarily translate directly to a corresponding number of beef females since there was no uniformity among producers in the number of animals acquired under the programme. The number varied from 4 to 40 with an average of 14. Given this average and the randomness with which the sample was chosen, we are prepared to accept that the composition of the group who would have proceeded without assistance could be expected to bear close resemblance to the sample group as a whole.

The fact that this estimate is not specific with respect to the year in which work would have been done as compared with the year work was actually done causes further uncertainty in the interpretation of the result. For example, the Survey indicates that 43.8 percent of the work would have been completed during 1976 and 1977. This is open to question on the one hand given the extremely low prices which prevailed in those years. But on the other hand, farmers would have had to have begun to retain heifers in those years if their intention was to be in a position to take advantage of the relatively high steer and heifer prices of 1978 and thereafter. This assumes they were able to predict the timing of the price rise accurately. This is, perhaps, not an unreasonable assumption.

We have accepted the Survey figure with the reservations noted above. The implication of this result is that the programme may be directly attributed

Table 5-10

FINANCIAL APPRAISAL OF BEEF PRODUCTION INCENTIVE POLICY
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)									BENEFITS($000)		TOTALS($000)		
	INVESTMENT		OPERATING COSTS											
YEAR	COWS& BULLS	BARNS	FEED	UTILI LITIES	MARKE TING	MAINTE NANCE	MORTA LITY	TAXES	OTHER	SALES	INCEN TIVE	COST	BENEFIT	NETFLOW
1	152.30	106.02	160.94	4.49	0.00	11.22	4.76	5.13	19.27	0.00	309.51	464.12	309.51	-154.61
2	152.62	71.36	409.51	27.73	2.57	69.32	29.39	7.92	119.03	42.86	175.48	889.44	218.34	-671.10
3	74.34	22.05	533.88	31.83	52.05	79.57	33.74	9.09	136.64	862.94	69.63	973.18	932.57	-40.60
4	146.82	75.55	710.77	47.46	76.97	118.65	50.31	13.56	203.74	1282.39	428.56	1443.82	1711.44	267.62
5	0.00	0.00	850.89	47.46	84.74	118.65	50.31	13.56	203.74	1534.29	0.00	1369.35	1534.29	164.94
6	0.00	0.00	850.89	47.46	66.94	118.65	50.31	13.56	203.74	1328.28	0.00	1351.55	1328.28	-23.27
7	0.00	0.00	850.89	47.46	135.08	118.65	50.31	13.56	203.74	1618.31	0.00	1419.69	1618.31	198.62
8	0.00	0.00	850.89	47.46	113.80	118.65	50.31	13.56	203.74	1463.91	0.00	1398.40	1463.91	65.51
9	0.00	0.00	850.89	47.46	85.08	118.65	50.31	13.56	203.74	1393.49	0.00	1369.68	1393.49	23.81
10	0.00	0.00	850.89	47.46	122.47	118.65	50.31	13.56	203.74	1555.29	0.00	1407.08	1555.29	14[illegible].22
11	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
12	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
13	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
14	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
15	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
16	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
17	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
18	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
19	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63
20	0.00	0.00	850.89	47.46	107.62	118.65	50.31	13.56	203.74	1471.86	0.00	1392.23	1471.86	79.63

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -65.25

with providing the incentive to expand the stock of breeding females by 43 percent or 2,983 head between 1976 and 1979. The analysis indicates that this increment would generate a net present value of ($ 430.600).

5.4.3 Financial Analysis

When viewed from the perspective of the private producer our analysis indicates that the Programme would generate a net present value of ($ 65.300) at a 10 percent discount rate. The results are set out in cash flow form in Table 5-10.

5.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie these analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) property taxes have been removed;

b) the subsidy on feed grain shipments (resulting in an average price reduction of $10/tonne) has been removed and is reflected in higher feed costs;

c) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

d) the incentive paid to producers for beef females purchased or retained has been removed from the revenue side;

e) the grant paid to farmers for barn construction under the Provincial Capital Grants Programme has been removed.

The effect of these adjustments is to lower the net present value of the programme from ($ 65,300) to ($1,001,520).

5.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Table 5-11. As indicated in Table 5-11, the base case net Present Value is extremely sensitive to changes in the discount rate, feed costs and in particular to changes in the price of beef. Note that a price increase of only 15 percent above that assumed in the base case will result in a positive net present value.

Table 5-11

Sensitivity Analysis
Beef Production Incentive Policy
(NPV in '000 $1978)

Cost-Benefit Analysis

Variables		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			(927.6)	(1001.5)	(1004.3)		
	BCR			.94	.90	.86		
Livestock	NPV	(938.4)	(959.5)	(980.5)		(1022.6)	(1043.6)	(1064.6)
	BCR	.91	.91	.91	.90	.90	.90	.90
Barns	NPV	(927.7)	982.3)	(991.9)	(1001.5)	(1011.1)	(1020.7)	(1030.4)
	BCR	.91	.91	.91	.90	.90	.90	.90
Feed	NPV	(69.4)	(380.1)	(690.8)	(1001.5)	(1312.2)	(1622.9)	(1933.6)
	BCR	.99	.96	.93	.90	.88	.85	.83
Revenue	NPV	(2419.5)	(1946.9)	(1474.2)	(1001.5)	(528.9)	(56.2)	416.5
	BCR	.77	.81	.86	.90	.95	.99	1.04

Financial Analysis

Variables		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			210.3	(65.3)	(205.4)		
	BCR			1.13	.99	.97		
Livestock	NPV	(2.1)	(23.2)	(44.2)	(65.3)	(86.3)	(107.3)	(128.4)
	BCR	1.00	.99	.99	.99	.99	.99	.99
Barns	NPV	(31.7)	(42.9)	(54.1)	(65.3)	(76.3)	(87.6)	(98.7)
	BCR	.99	.99	.99	.99	.99	.99	.99
Feed	NPV	822.5	526.6	230.7	(65.3)	(361.2)	(657.1)	(953.0)
	BCR	1.09	1.05	1.02	.99	.97	.94	.91
Revenue	NPV	(1483.2)	(1010.6)	(537.9)	(65.3)	407.4	880.1	1352.7
	BCR	.86	.90	.94	.99	1.04	1.09	1.13

Note: Figures in brackets denote negative values.

6. Hog Production Incentive

6.1 Sector Profile

Hog production in Nova Scotia had undergone considerable expansion in the twenty-five years prior to the inception of the ADA incentive programme. Between 1961 and 1975 commercial marketings of hogs grew from 49,781 to 106,054, a compound annual growth rate of 5.6 percent. Over this period the number of farms producing market hogs has increased from about 400 to over 500, although for most of these farms hog production is but one aspect of a mixed operation and the numbers produced are relatively small. In the mid-1970's, farms producing 1000 hogs or more accounted for only about 6 percent of producers, but in the range of 65 percent of production. Some 50 percent of producers had output of less than 20 hogs.

Hog production operations can be divided into three principal categories:

i) producers of weanlings
ii) feeder-hog operations, and
iii) farrow-to-finish operations.

The latter category as the name implies involves all steps in the productive process from breeding to raising pigs to market size. In recent years the trend in Nova Scotia has been to establish farrow-to-finish units and at present this type of operation predominates.

Sows in Nova Scotia operations average just over two litters per year with litter size varying from 8 to 12 piglets (the sows of more efficient producers achieve 2.4 litters per year). Pigs are weaned at 4 to 6 weeks and are fed exclusively on ration from that time in commercial operations. Hogs reach market weight of 165 to 175 pounds in 5 to 6 months. Thus, although a sow will produce two litters per year, a period of at least 15 months is required to bring two full litters to market weight. Accordingly, after allowing for mortality, average annual production of market hogs per sow is in the range of 14 hogs (See Table 6-5).

Hog production in Nova Scotia has become an operation of increasing sophistication and capital intensiveness in the past decade. Estimates provided by the Department of Agriculture and Marketing indicate that the building and equipment for a 65-sow farrow-to-finish operation would require an investment of approximately $117,000 in 1980, or $1,800 per sow. The breeding stock of 65 sows and 3 boars would require a further investment of approximately $20,000. As investment requirements have continued to rise throughout the decade, entrance into the industry has become increasingly difficult. Likewise, the rate of expansion by existing producers also decreased resulting in relatively constant production in the early 1970's, notwithstanding the price increases which occurred during the period. (See Table 6-1 for a comparison of hog production and prices for the five years leading to the inception of the Hog Production Incentive programme.)

Table 6-1

Hog Production and Prices in Nova Scotia
1972 - 1976

	Prices $/cwt	Hogs Marketed
1976	63.53	107,468
1975	67.53	106,054
1974	49.85	107,959
1973	53.76	106,524
1972	36.41	108,547

Source: Province of Nova Scotia, Agricultural Statistics 1978, Tables 21 and 24.

Between 95 and 99 percent of all hogs marketed commercially in the Province are sold through the Nova Scotia Hog Marketing Board. The principal function of the Board is to facilitate marketing operations. It has virtually no influence on prices which respond to the forces of supply and demand in national and international markets.

Hog producers in Nova Scotia are insulated from the direct effects of hog price cycle movements through their (voluntary) participation in the Pork Price Stabilization Programme. The primary objective of the Programme is to remove the high peaks and low depressions of returns caused by price cycles so that returns to producers will be relatively constant. Producers pay into a stabilization fund when prices are high and draw from the fund when prices are low. During times of relatively low prices producers would receive a stabilization price which reflects all current, direct, out-of-pocket operating costs. Table 6-2 offers a comparison of market versus stabilization prices for the past seven years.

Table 6-2

Market vs. Stabilization Prices and Hogs Marketed
Nova Scotia 1974 - 1980
(current dollars)

	Market Price (yearly average)	Stabilization Price (yearly average)	Hogs Marketed (numbers)
1980	52.84	66.33	180,574 (1)
1979	62.68	62.50	153,022
1978	68.69	57.50	130,386
1977	60.17	56.50	116,484
1976	63.53	58.63	105,609
1975	67.53	55.50	106,054
1974	49.85	51.17	107,468

Sources: Province of Nova Scotia, Agricultural Statistics 1978, Table 21; and, Department of Agriculture and Marketing, Weekly Market Report.

Note: 1. This is an estimate based on marketings to August 16, 1980.

Price stability and high and rising costs of entering the industry have combined to damp the occillations which occurred in hog production with the movement in and out of the industry by small producers in response to changing prices. The result has been a more efficient use of existing capacity both in production and processing. Moreover, with increased stability producers have been able to concentrate resources on improvements in the quality of hogs produced. As Table 6-3 indicates, Nova Scotia producers exceed the Canadian average in terms of the quality of pork sold.

Table 6-3

Pork Quality Index
Canada vs. Nova Scotia
1975

Index	Nova Scotia	Canada
109 and over	9.9%	4.3%
105 - 108	30.6%	18.7%
102 - 104	35.6%	33.3%
101 and under	23.9%	43.7%

Source: DREE Project Brief.

As noted above, in spite of rising prices in the early 1970's expansion within the hog sector came to a standstill. At that time Nova Scotia producers accounted for only 37 percent of Provincial requirements with much of the balance imported from Quebec. It was felt that potential existed for profitable expansion within this sector.

6.2 Project Description

6.2.1 Objectives

The purpose of the Hog Production Incentive Project is to assist in the expansion of the hog industry by providing incentive grants for new or expanded hog production units.

Over the five-year life of the project it was expected that the equivalent of one hundred 60 sow farrow-to-finish units would be added to the existing base. A number of conditions must be satisfied in order to qualify for assistance:

i) the farm must have an adequate land base to handle the manure produced;

ii) the producer must be established, or in the case of a new entrant, must be able to demonstrate his ability to operate a hog production unit;

iii) the producer must be eligible for commercial farmer loans under the regulations of the Nova Scotia Farm Loan Board or the Federal Farm Credit Corporation.

The scope of assistance available is limited to a grant of 25 percent of the construction costs of facilities (buildings and equipment) to a maximum of \$20,000 per farmer over the duration of the programme. The estimated five year cost of the programme was \$8 million to be divided as follows:

Federal Share	Provincial Share	Producers' Share
\$1,600,000	\$400,000	\$6,000,000

6.2.2 Project Performance

The rate of expansion achieved under the Incentive Programme in its first four years is summarized in Table 6-4. The number of 65 sow equivalent units developed between 1976 and 1979 has been estimated according to the following formula:

$$\left(\begin{array}{l}\text{total grant}\\ \text{per year}\end{array} \div \begin{array}{l}\text{percentage of}\\ \text{capital cost}\end{array}\right) \div \left(\begin{array}{c}\text{capital cost}\\ \text{per sow}\end{array}\right) \div 65 = \begin{array}{l}\text{number of sow}\\ \text{equivalent units}\end{array}$$

Taking 1976 as an example we have:

total grant	= \$310,829
percentage of capital costs	= .25
capital cost per sow	= \$1,200

which, when put into the formula will yield the following result:

$$\$310{,}829 \div .25 \div \$1{,}200 \div 65 = 17.27$$

This implies that for 1976, the number of new 65 sow equivalent developments was just over 17.

By using estimates for capital costs per sow provided by the Department of Agriculture and Marketing for the years 1976 to 1979 we have arrived at an estimate of the number of new units for each of the first four years of the programme. These estimates, set out in Column 7 of Table 6-4, indicate that 92-65 sow equivalent units have been developed over the first four years. This total may understate slightly the actual number of units since the capital cost per sow figure is based on costs of constructing a new facility and may exceed the unit cost of adding new capacity to existing structures.* If an adjustment were made for this, and, given the approximately $200,000 in grants remaining to be dispensed, the Programme should exceed its target of one hundred-60 sow units in 1980 by approximately 10.

The impact that the increase in sow numbers has had on marketings is presented in Table 6-2. Following five years of relatively constant production (from 1972-1976) output has increased at an annual average rate of 14.4 percent from 105,609 hogs in 1976 to an estimated 180,000 in 1980. At an average rate of 14 hogs marketed per sow this implies a <u>net</u> increase in the sow population of approximately 5,300 since the programme's inception. Although this net increase is less than the increase in sows (approximately 6,000) suggested above in the estimate of the number of 60 sow equivalent units constructed under the incentive programme, this does not necessarily mean

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* It should be noted that our estimate of the number of sow equivalent units is less than that estimated in the Annual Reports. It would appear that the latter estimates were based on an assumption of constant capital costs of facilities of $1,000 per sow over the first four years of the programme.

Table 6-4

Hog Production Incentive Project
Facilities Expansion 1976-1979

Year	New Buildings Units	New Buildings Grants ($)	Renovations Units	Renovations Grants ($)	Total Developments Units	Total Developments Grants ($)	Development in Sow Equivalent Units
	1	2	3	4	5	6	7
1976	61	308,374	4	2,455	65	310,829	17.27
1977	81	391,140	3	1,225	84	392,365	20.19
1978	137	496,955	23	12,098	160	509,053	25.93
1979	49	569,697	53	27,878	102	597,575	29.19
TOTAL	328	1,766,166	83	43,656	411	1,809,822	92.08

Source: ADA Annual Reports, 1976-1979.

Notes: 1. Capital cost per sow estimates upon which these figures are based are as follows:

1976 .... $1,200
1977 1,300
1978 1,400
1978 1,500

2. The figures in Column 7 refer to 65 sow equivalent units. The number of 60 sow units is (92.08 x 65) ÷ 60 = 99.75.

that the programme target was not reached. The difference can be explained, for example, by breeding stock liquidation which might have occurred in the case of some smaller, non-participating producers.*

The increase of some 75,000 market hogs in 1980 as compared with 1976 output has meant an improvement in the degree of self-sufficiency Nova Scotia now enjoys in hog production which now stands at 41 percent as compared with 37 percent in 1973. All of this increase, of course, cannot be attributed solely to the incentive programme. An assessment of the impact of the programme on production will be made in Section 6.3.

6.2.3 Participant Profile

An estimated 200 producers participated in the incentive programme over its five year life with most of these participating in more than one year. A profile of the average participant based on information contained in the Survey is presented in Table 6-5. This information covers only the first three years of the programme and was based on a sample of 26 producers, 20 percent of the total individual participants (132) up to that point. The information reproduced here provides a rough indication only of the average operation. For a more detailed description of participants see Sorflaten 1980.

The salient features to note about the average operation are that:

a) capacity for 64 sows and 822 feeders was added;
b) the weanling rate was 16.1 hogs per sow per year;
c) the number of hogs marketed per sow per year was 14.4;
d) hired employees numbered 1.7 persons
e) forty-six percent of those participating would have undertaken the work without assistance.

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* Participants were, after all, required to expand productive capacity. The incentive was not provided to allow producers to replace existing facilities.

Table 6-5

Profile of Average Participant
Hog Production Incentive

Item	Number of Responses	Average Measure	or Percentage
1. Age of operator	26	39.8 years	-
2. Type of farm:	26		
family		21	80.5
partnership		5	19.2
3. Total land area operated	26	345 acres	-
4. Value of land and buildings	26	$206,269	-
5. Value of Machinery and equipment	26	$ 38,926	-
6. Total cattle and calves	14	39 head	-
7. Total Sheep	2	453 head	-
8. Total poultry: chickens	2	27	-
geese	1	60	-
ducks	1	15	-
9. Labour: employees	10	1.7 persons	-
weeks paid labour - male	17	77.2 weeks	-
female	2	68.0 weeks	-
10. Off farm work/year	6	192.5 days	-
11. Value of products sold	26		
0 - 24,999	5		19.2
25,000 - 49,999	7		27.0
50,000 - 74,999	3		11.5
75,000 or more	11		42.3
12. Total pigs: 6 months and over	22	89.1	-
3-6 months	24	328.6	-
0-3 months	26	338.1	-
13. Capacity added: new	19	7,352 sq.ft.	-
renovated	7	4,134 sq.ft.	-
14. Animals added: sows	18	65.2	-
feeders	23	821.9	-
15. Total cost of new or renovated born	26	$58,626	-
16. Cost covered by incentive		-	17.5
17. Weanling rate	26	16.1/sow/yr.	-
18. Market hogs		14.4/sow/yr.	-
19. Percent of hog feed grown on farm	5	-	37.4
20. Number who would have proceeded without grant	26	12	46.2

6.3 Methodology

6.3.1 Methodological Issues

In general, the method used in the Cost-Benefit Analysis of the Hog Production Incentive Programme conforms to the conventional approach set out in Chapter Two. Incremental capital and operating costs and revenues were estimated using historical data and by simulating the operation of a 65 sow farrow-to-finish production unit over the twenty year evaluation period. The results of this analysis were generalized to all participating producers and an adjustement made for incrementality in order to assess the performance of the overall programme.

6.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis:

a) Unit Size: all cost and benefit estimates are based on a 65 sow farrow-to-finish unit, the average increase in breeding stock size according to the Survey.

b) Base Year: all cost and benefit projections are expressed in 1978 constant dollars.

c) Revenue: all revenue projections are based on the weighted average price which prevailed for hogs in Nova Scotia from 1976 to 1979. This was $64.00/cwt ($ 1978) for index 100 hogs. An average index of 103 was applied to all hogs marketed and an average weight of 1.65 cwt assumed. Accordingly, the revenue per hog was:

$$1.65 \times \$64 \times 1.03 = \$108.80$$

d) Hogs Marketed: the number of hogs marketed per sow was assumed to be 15 per year, slightly higher than the Provincial average (14). This was assumed to increase to 16 per year in the eleventh year of the evaluation period due to technological and efficiency improvements.

e) Capital costs: are as follows:

   i) land: one acre per sow at $275/acre. Since land costs would have offsetting revenue from crop production it would not be correct to show only costs. To simplify the analysis, it was assumed that all land purchased to qualify for the grant would be used for crop production and hence should not be charged as a financial or economic cost to the project.

ii) buildings: the average cost of serviced buildings between 1976 and 1979 was estimated to be $61,000 or $938 per sow.

iii) equipment: estimated at $31,000 or $477 per sow.

iv) machinery: producers have the alternative of purchasing machinery (tractor, tanker, spreader, etc.) at an estimated $30,000 ($450 per sow) or hire service on a custom based estimated at $30/hr x 125 hrs = $3,750 ($58 per sow). The actual average cost would lie somewhere in between and has been estimated at $200/sow.

v) livestock: sows $250 each x 65 = $16,250

boars $400 each x 4 = $ 1,600

f) Production: build-up of livestock commences upon completion of facilities (6 month construction period) and is completed within one year of that time. First marketings occur in year two estimated at 75 percent of normal operations. Animals are assumed to have a salvage value of $100 after three productive years.

g) Feed Costs:

Sows - dry	1,520 lbs x $.0780 x 65 =	7,706
nursing	680 lbs x $.0861 x 65 =	3,806
Boars	2,350 lbs x $.0780 x 4 =	733
Marketing Hogs:		
prestarter	15 lbs x $.1487 x 975 =	2,174
starter	60 lbs x $.1061 x 975 =	6,207
grower	525 lbs x $.0807 x 975 =	41,308

h) Other Variable Costs: these have been obtained from the Department of Agriculture and Marketing, Farm Management 1978-18.

i) Labour: one employee per 65 sow unit at 45 hours per week. A wage of $3.50 per hour has been assumed. Annual cost:

45 x $3.50 x 52 = $8,190

j) Capacity Utilization: facilities will be used to full capacity since producers are insulated from price fluctuation through the Price Stabilization Programme.

k) Manure Credit: the value of manure produced was estimated at $589 per year and included under "other benefits."

6.4 Results

6.4.1 Cost-Benefit Analysis

The costs and beneftis of the base case 65 sow farrow-to-finish unit are set out in cash flow form in Table 6-6. The analysis indicates that the project will yield the following results:

Net Present Value	$10,170
Benefit-Cost Ratio	1.01

The base case result is for a single 65 sow project. We estimate that over the first four years of the programme the equivalent of 92.1 such projects were undertaken (see Table 6-4). The programme as a whole, accordingly, will yield the following results:

Net Present Value	$936,657
Benefit-Cost Ratio	1.01

The results indicate that from the perspective of society as a whole the programme to date has been worthwhile.

6.4.2 Incrementality

The gross net present value of $936,657 cannot be attributed exclusively to incentives provided under the programme. The Survey indicates that 46 percent of those participating would have undertaken the work without assistance. This conclusion is reasonable given the rate of return which hog producers could expect to receive. The implication of this finding is that the programme in fact contributed directly to the initiation of approximately fifty 65 sow farrow-to-finish units. These would generate a NPV of $508,500.

6.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the private producer who actually makes the investment. The results using this approach are set out in Table 6-7.

Table 6-6

ECONOMIC APPRAISAL OF A 65-SOW FARROW TO FINISH UNIT
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)										BENEFITS($000)		TOTALS($000)		
	INVESTMENT		OPERATING COSTS												
YEAR	LAND	MACHE EQUIP	LIVE STOCK	INSU RANCE	REPAI RS	TAXES	FEED	MARKE TING	LABOR	OTHER	SALES	OTHER	COST	BENEFIT	NETFLOW
1	52.46	41.21	8.93	.95	1.70	0.00	9.95	0.00	2.46	2.45	0.00	.42	120.11	.42	-119.69
2	0.00	0.00	8.93	1.87	3.40	0.00	51.17	2.29	4.92	4.91	79.54	.43	77.48	79.96	2.49
3	0.00	0.00	0.00	1.91	3.40	0.00	65.03	3.12	4.92	4.91	106.05	.46	83.28	106.51	23.22
4	0.00	0.00	8.93	1.91	3.40	0.00	65.03	3.12	4.92	4.91	106.05	3.98	92.21	110.03	17.82
5	0.00	0.00	8.93	1.91	3.40	0.00	65.03	3.12	4.92	4.91	106.05	4.04	92.21	110.09	17.88
6	0.00	13.00	0.00	1.91	3.40	0.00	65.03	3.12	4.92	4.91	106.05	4.79	96.28	110.84	14.56
7	0.00	0.00	8.93	1.91	3.40	0.00	65.03	3.12	4.92	4.91	106.05	4.04	92.21	110.09	17.88
8	0.00	0.00	8.93	1.91	3.40	0.00	65.03	3.12	4.92	4.91	106.05	4.04	92.21	110.09	17.88
9	0.00	0.00	0.00	1.91	3.40	0.00	65.03	3.12	5.74	4.91	106.05	.59	84.10	106.64	22.54
10	0.00	0.00	8.93	1.91	3.40	0.00	65.03	3.12	6.15	4.91	106.05	4.04	93.44	110.09	16.65
11	0.00	41.21	8.93	1.91	3.40	0.00	68.49	3.33	6.56	5.01	113.36	8.24	138.83	121.60	-17.23
12	0.00	0.00	0.00	1.91	3.40	0.00	68.49	3.33	6.97	5.01	113.36	.59	89.10	113.95	24.85
13	0.00	0.00	8.93	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	4.04	98.44	117.40	18.96
14	0.00	0.00	8.93	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	4.04	98.44	117.40	18.96
15	0.00	0.00	0.00	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	.59	89.51	113.95	24.44
16	0.00	13.00	8.93	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	8.24	111.44	121.60	10.16
17	0.00	0.00	8.93	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	4.04	98.44	117.40	18.96
18	0.00	0.00	0.00	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	.59	89.51	113.95	24.44
19	0.00	0.00	8.93	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	4.04	98.44	117.40	18.96
20	0.00	0.00	8.93	1.91	3.40	0.00	68.49	3.33	7.38	5.01	113.36	4.04	98.44	117.40	18.96

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 10.17

Table 6-7

FINANCIAL APPRAISAL OF A 65-SOW FARROW TO FINISH UNIT
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)										BENEFITS($000)		TOTALS($000)		
	INVESTMENT			OPERATING COSTS											
YEAR	LAND	MACHE EQUIP	LIVE STOCK	INSU RANCE	REPAI RS	TAXES	FEED	MARKE TING	LABOR	OTHER	SALES	OTHER	COST	BENEFIT	NETFLOW
1	61.00	44.00	8.93	.95	1.70	.92	9.48	0.00	4.10	2.45	0.00	20.42	133.53	20.42	-113.11
2	0.00	0.00	8.93	1.87	3.40	.92	48.73	2.29	8.20	4.91	79.99	.43	79.24	80.42	1.18
3	0.00	0.00	0.00	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	.46	84.39	107.19	22.80
4	0.00	0.00	8.93	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	3.98	93.31	110.71	17.40
5	0.00	0.00	8.93	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	4.04	93.31	110.77	17.46
6	0.00	13.00	0.00	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	4.79	97.39	111.52	14.14
7	0.00	0.00	8.93	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	4.04	93.31	110.77	17.46
8	0.00	0.00	8.93	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	4.04	93.31	110.77	17.46
9	0.00	0.00	0.00	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	.59	84.39	107.32	22.94
10	0.00	0.00	8.93	1.91	3.40	.92	61.93	3.12	8.20	4.91	106.73	4.04	93.31	110.77	17.46
11	0.00	44.00	8.93	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	8.24	140.92	122.33	-18.59
12	0.00	0.00	0.00	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	.59	87.99	114.68	26.69
13	0.00	0.00	8.93	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	4.04	96.92	118.13	21.21
14	0.00	0.00	8.93	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	4.04	96.92	118.13	21.21
15	0.00	0.00	0.00	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	.59	87.99	114.68	26.69
16	0.00	13.00	8.93	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	8.24	109.92	122.33	12.41
17	0.00	0.00	8.93	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	4.04	96.92	118.13	21.21
18	0.00	0.00	0.00	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	.59	87.99	114.68	26.69
19	0.00	0.00	8.93	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	4.04	96.92	118.13	21.21
20	0.00	0.00	8.93	1.91	3.40	.92	65.23	3.33	8.20	5.01	114.09	4.04	96.92	118.13	21.21

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 17.98

The base case project would generate a NPV of $17,980.

6.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) all provincial and federal sales and property taxes have been removed;

b) the subsidy on feed grain shipments (on average of $10 per tonne) has been removed and is reflected in higher feed costs;

c) the transportation subsidy paid to hog producers had been removed from the revenue side;

d) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

e) the capital grant of 25 percent of the cost of buildings and equipment (up to $20,000) has been removed from the revenue side.

The effect of these adjustments is to lower the net present value of the project from $17,980 to $10,170.

6.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Table 6-8. As indicated, the base case net present value is extremely sensitive to changes in the discount rate, to changes in revenue due either to output or price changes, and to changes in feed prices.

Table 6-8

Sensitivity Analysis
Hog Production Incentive Programme
(NPV in '000 $1978)

Variable		Cost-Benefit Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			70.3	10.2	(21.5)		
	BCR			1.06	1.01	.96		
Building	NPV	17.3	14.9	12.6	10.2	7.8	5.4	3.0
	BCR	1.02	1.02	1.02	1.01	1.02	1.02	1.02
Mach & Equip	NPV	19.5	16.4	13.3	10.2	7.1	4.0	0.9
	BCR	1.02	1.02	1.02	1.01	1.01	1.00	1.00
Livestock	NPV	18.3	15.6	12.9	10.2	7.5	4.8	2.1
	BCR	1.02	1.02	1.02	1.01	1.01	1.01	1.00
Feed	NPV	85.2	60.2	35.2	10.2	(14.8)	(39.9)	(64.9)
	BCR	1.11	1.08	1.04	1.01	.98	.95	.93
Labour	NPV	17.1	14.8	12.5	10.2	7.9	5.6	3.3
	BCR	1.02	1.02	1.02	1.01	1.01	1.01	1.00
Revenue	NPV	(110.1)	(70.0)	(29.9)	10.2	50.3	90.5	130.5
	BCR	.87	.91	.96	1.01	1.06	1.11	1.16

Variable		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			82.5	18.0	(15.7)		
	BCR			1.07	1.02	.97		
Building	NPV	26.3	23.5	20.8	18.0	15.2	12.4	9.7
	BCR	1.03	1.03	1.03	1.02	1.02	1.01	1.01
Mach & Equip	NPV	27.8	24.5	21.2	18.0	14.7	11.4	8.1
	BCR	1.03	1.03	1.03	1.02	1.02	1.01	1.01
Livestock	NPV	26.1	23.4	20.7	18.0	15.3	12.6	9.9
	BCR	1.03	1.03	1.02	1.02	1.02	1.02	1.01
Feed	NPV	89.5	65.6	41.8	18.0	(5.8)	(29.7)	(53.5)
	BCR	1.12	1.08	1.05	1.02	.99	.97	.94
Labour	NPV	27.9	24.6	21.3	18.0	14.7	11.3	8.1
	BCR	1.03	1.03	1.03	1.02	1.02	1.01	1.01
Revenue	NPV	(103.1)	(62.7)	(22.4)	18.0	58.3	98.7	139.0
	BCR	.88	.92	.97	1.02	1.07	1.12	1.17

Note 1: Figures in brackets denote negative values.

7.0 Sheep Production Incentive

7.1 Sector Profile

Sheep production has been in a state of decline since the Provincial herd peaked in size in 1921. Once an important source of meat and wool, particularly for on-farm use, the sector has been adversely affected by the rise of specialization in trade and agriculture. Its relative importance in Nova Scotia agriculture has been considerably diminished.

Since World War II the number of sheep and lambs on farms has gone down from almost 100,000 to 41,000 (in 1975). Most of this change occurred up to the mid-1960's. The Province introduced a Sheep Production Policy (before the present incentive) in 1974 and in 1975-76 the Cape Breton Development Corporation imported 2,600 breeding sheep. Coupled with higher and rapidly increasing prices since 1971 numbers have begun to recover. Prices for lamb in 1971 were about $31/cwt and increased to $80/cwt by 1978; over the same five-year period the price of mutton increased by 175 percent from $14-15/cwt to $40/cwt (see Table 7-1).

Table 7-1

Sheep Production, Prices and Commercial Marketings, Nova Scotia, 1961 - 1979

	Price ($/cwt)		Number on farms		Total Commercial
	Lamb	Mutton	Lambs	Sheep	Marketings
1979	N/A	N/A	41,000		3,314
1978	79.13	38.85	18,000	21,000	1,635
1977	62.22	30.03	18,300	21,400	2,995
1976	53.42	26.21	17,300	20,700	3,907
1975	58.54	25.04	16,500	19,200	4,131
1974	48.64	23.45	16,200	17,500	4,866
1973	42.87	21.76	16,500	17,700	4,444
1972	34.73	14.17	17,300	18,100	3,083
1971	30.65	14.07	17,131	18,706	2,682
1966	26,50	10.60	18,960	19,867	3,719
1961	20.80	9.02	30,042	34,612	8,701

Source: Agriculture Canada, Livestock Market Review, Nova Scotia Department of Agriuclture and Marketing, Agricultural Statistics 1978, Tables 18 and 21.

The average size of commercial flocks increased from about 300 to 365 animals between 1971 and 1976 indicating that, as in other enterprises, sheep operations are fewer but bigger. There are, however, only a few big producers in Nova Scotia; in 1976 the eight largest averaged breeding flocks of 730 head with an average gross income between \$45,000 and \$50,000, much less than for other types of enterprise. Small commercial farms (those with less than \$25,000 in gross farm sales) accounted for 50 percent of all sheep on farms in 1976. There are marked concentrations of sheep in Inverness and Pictou counties.

Much of the Atlantic Region is well-suited to sheep production because of good, perennial pastures and topographic and climatic factors which may make more mechanized or intensive types of enterprise marginal. Neither local nor national consumption of lamb or mutton, however, have increased since World War II except in response to higher prices for beef and pork. Most commercial sheep farmers aim at producing market lambs (80 to 100 lbs) at 5 months. Breeding ewes are at peak production between 3 and 5 years of age.

Markets for sheep products are quite predictable with a peak for lambs around Easter, mainly in the "ethnic" markets of larger urban centres. Numbers of marketings are, however, difficult to estimate because of an appreciable proportion of sales directly from producer to slaughter-plant, retailer or consumer. Commercial marketings normally account for only about 25 percent of output with an increasing proportion going directly to the plant or being sold in the Toronto and Montreal stockyards. Table 7-2 outlines the disposition of output.

The increase in "direct" sales or in sales in general Canadian auctions has, at least in part, caused the closing of two out of three provincial slaughter operators which specialized in sheep.

Table 7-2

Disposition of Sheep and Lamb Output, Nova Scotia 1972 - 77

Year	Consumed on Farms	Killed & Sold	Commercial Yards	Marketings Plants	Local Slaughter	Residual	Estimated Disposal
1977	500	5,600	878	2,117	2,900	6,500	18,500
1976	400	7,300	1,278	2,629	2,300	1,700	15,600
1975	300	5,200	1,119	3,012	2,000	3,400	15,100
1974	400	3,100	651	4,215	2,100	5,000	15,500
1973	500	2,950	687	3,757	2,450	5,000	16,000
1972	500	3,000	623	2,460	4,100	6,300	16,900

Source: Economics Report - The Sheep Industry in Nova Scotia, Nova Scotia Department of Agriculture and Marketing, Table IV, p. 5.

7.2 Project Description

7.2.1 Objectives

Development opportunities for mutton and lamb were estimated at about 31,000 animals for 1973 solely to meet demand in Nova Scotia. The incentive aimed to increase the breeding stock of ewes by 12,000 head over the five years of the Agreement. Assistance would be provided as a grant of $25 per ewe lamb and $35 per yearling ewe purchased or retained up to a maximum of 20 percent of the basic ewe flock in any one year. Eligibility for assistance required:

a) a flock of at least 40 breeding ewes;
b) retention or purchase of at least 5 breeding females;
c) enrolment in the Nova Scotia Record of Performance Program if applying for assistance on retained ewe lambs and yearlings, or if purchasing then purchases from flocks enrolled in the R.O.P. Programme; and,
d) adequate resources to carry out an expansion program aimed at developing a high quality flock.

The total estimated cost of the incentive is $300,000 to be divided as follows:

Federal Share	Provincial Share
$240,000	$60,000

7.2.2 Project Performance

Incentive grants totalled $170,120 over the first four years of the program for a total increase in herd size of 6,563 ewe lambs and 179 yearling ewes. About 84 percent of the increase was based on retaining ewes for breeding, the remaining 16 percent were purchased. Expenditures under the incentive have not been evenly spread over the four years with 35 percent of the total being taken up in 1976, 25 percent in 1977, 15 percent in 1978 and 25 percent in 1979. Participation by farmers in the incentive has been much more even with only 1978 being abnormally low relative to the other 3 years (See Table 7-3). The distribution of the increase in breeding stock over time is closely related to the distribution of expenditures. The $170,520 of total expenditures represents

Table 7-3

Expenditures and Participation under the Sheep Production Incentive, 1976-79

	1976	1977	1978	1979	Total 1976-79
Expenditures:					
$	60,125	42,150	25,355	42,890	170,520
% of Total	35.3	24.7	14.9	25.1	100.0
Participation:					
Number	83	81	44	71	279
% of Total	29.7	29.0	15.8	25.5	100.0
Increase in Breeding Stock:					
Number	2,405	1,686	961	1,690	6,742
% of Total	35.7	25.0	14.3	25.0	100.0

Source: ADA Annual Reports, 1976-1979.

only 56.8 percent of the amount allocated and it seems unlikely that the total amount of $300,000 will be spent by the time the incentive expires. The total addition to the provincial breeding flock (6,742 ewes) represents 56.1 percent of the intended 12,000 head.

Although a total of 279 applications for the incentive were approved over the first four years, it is unlikely this represented 279 individual applicants as several will have applied successfully more than once for assistance. For the purposes of the present evaluation the number of individual participants over the first four years was assumed to be 200 and the average increase in their breeding flock, also over the four years, would then be:

$$6,742 \div 200 = 33$$

This increase was apportioned *pro-rata* according to annual increase of the provincial flock (Table 7-3). Thus for an "average" sheep enterprise the total increment was accumulated as:

1976	12	35.7%
1977	8	25.0%
1978	5	14.3%
1979	8	25.0%
TOTAL	33	100.0%

Total increase in the provincial flock between 1976 and 1979 was from 38,700 animals to 41,000, a total of 2,300 animals. The discrepancy between the two figures (2,300 vs. 6,742) indicates a strong build-up in the flock during those years, amounting to more than 4,400 animals.

7.2.3 Participant Profile

A profile of the average participant in this programme is presented in Table 7-4. The information is derived from a sample of 27 participants surveyed after the first 3 years of the ADA, and therefore only provides a rough indication of the average operation. In general, this is quite a small, mixed farming enterprise.

Salient features are:

a) an average of 87 lambs less than 1 year old, and 157 sheep more than 1 year old;

b) 124 breeding ewes before expansion;

c) 489 acres of land;

d) 61 cattle and calves, including a milking herd of 32 head;

e) 35 pigs;

f) a considerable amount of off-farm work, averaging 127 weeks annually;

For more detail, refer to Sorflaten (1980).

Table 7-4

Profile of Average Participant
Sheep Production Incentive

Item	Number of Responses	Average Measure	Average Percentage
1. Age of Operator	27	51.04 years	
2. Type of farm: family	27		100.0
3. Total land area operated	27	489 acres	
4. Value of land and buildings	27	$128,481	
5. Value of machinery and equipment	27	$32,064	
6. Total sheep and lambs:			
less than 1 year	24	87	
more than 1 year	25	157	
7. Number of breeding ewes before expansion	26	124	
8. Total cattle and calves	21	61	
9. Cows and heifers for milking	8	32	
10. Total pigs	9	35	
11. Sows for breeding	4	21	
12. Total poultry:			
chickens	4	31	
turkeys	1	9	
geese	4	26	
ducks	5	41	
13. Year-round employees	3	2	
14. Paid labour - male	12	30 weeks	
female	1	18 weeks	
15. Off-farm work	14	127 days	
16. Value of products sold:			
0 - $24,999	19		70.4
25,000 - $49,999	4		14.8
50,000 - $74,999	1		3.7
75,000 and over	3		11.1

7.3 Methodology

7.3.1 Methodological Issues

In general the method used for the analysis of the Sheep Production Incentive conforms to the conventional approach set out in Chapter Two. Incremental capital and operating costs were estimated using historical data and by simulating the operation of a flock containing 124 breeding ewes at the inception of the incentive and over a 20-year period.

7.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis:

a) Unit Size: a flock size of 124 breeding ewes coming into year 1, is based on Survey data from a sample of 27 farmers who took up the Sheep Production Incentive. There are 3 rams per 100 breeding ewes.

b) Growth in Flock Size: was derived from Survey data; 200 participants up to 1979 had an average increase in the number of breeding ewes of 33 animals. This increase was allocated *pro rata* according to payments under the programme for each of the four years. Thereafter a rate of increase of one percent compounded over the remainder of the 20 years was assumed.

c) Cost and Benefit Projections: all are expressed in 1978 constant dollars.

d) Revenues: all were based on 1978 prices - \$57 for lambs, \$29 for cull ewes, \$16 for cull rams, wool at 70¢/lb.

e) Lambing Percentage: a percentage of 120 per 100 ewes with a 15 animal replacement rate gives marketings of 105 lambs each year. Cull ewes are marketed at the rate of 11 percent, cull rams at the rate of 3 percent, each rounded to the nearest whole number. Wool yield is 6 lbs/fleece.

f) Capital Costs: are estimated as follows:

   i) Buildings and equipment: an extension in year 3 was designed to reflect the need for extra capacity due to the incentive, and a figure of \$500 was derived from the Provincial Capital Costs Programme. A new facility was built in year 10 to replace the existing one. A figure of \$10,000 for this is from enterprise data for 1978 with allowance for advances in technology.

   ii) Livestock costs: were computed on the basis of \$64 per breeding ewe with allowance for retention of stock rather than purchase of other animals.

g) Operating Costs:

	\$/ewe
Hay (30 tons @ \$15/ton)	15
Grain (100 lbs/ewe @ 7¢/lb)	7
Grain (100 lbs/lamb @ 7.88¢/lb)	7.88
Salt and Minerals	.65
Veterinary and Medicine	2.25
Fertilizer	4.14
Lime	2.99
Marketing	1.35
Building Tax	.43
Utilities	1.50
Insurance	.90
Miscellaneous	2.00

These figures are derived from Enterprise Data Sheet for 1978 (431.821) for a semi-enclosed enterprise. In addition to these costs, building and fence maintenance costs were computed at a constant 3 percent of capital costs.

h) Labour: a figure of \$17.50/ewe was derived from Investment Limits, Sheep. In year 1 this would translate roughly to 1/3 man-year (2,000 hours at \$3.50/hour) rising to almost 1/2 man-year in year 20.

7.4 Results

7.4.1 Cost-Benefit Analysis

The costs and benefits of expanding a 124 breeding ewe flock are set out in cash flow form in Table 7-5. This indicates that the project will yield the following results:

Net Present Value	\$ 1,930
Benefit-Cost Ratio	1.02

These results are for a single enterprise. Over the first four years of the programme we estimate that 200 such projects were undertaken. For the programme as a whole, therefore, the results will be:

Net Present Value	\$ 386,000
Benefit-Cost Ratio	1.02

These results indicate that the programme has been beneficial to society as a whole.

7.4.2 Incrementality

The gross net present value of \$ 386,000 cannot be attributed exclusively to the Agreement's programmes. The Survey indicated that 70 percent of those participating would have undertaken the work without assistance. Recent lamb and mutton prices seem to support this view and direct contributions to expansion from the incentive may be to as few as 60 operators. These would generate a net present value of \$ 115,800.

7.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the private producer who actually makes the investment. The results from this approach are set out in Table 7-6. From this approach the net present value would be a loss, on an enterprise basis, of \$ 3,730.

Table 7-5

ECONOMIC APPRAISAL OF A SHEEP PRODUCTION UNIT
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)										BENEFITS($000)				TOTALS($000)		
	INVESTMENT			OPERATING COSTS													
YEAR	BUILD EQUIP	LIVE STOCK	FEED	FERTI LIME	REPAI	SALT& MINE	MARKE TING	SHEA RING	LABOR	OTHER	LAMBS	CULLS	WOOL	INCEN TIVE	COST	BENEFIT	NETFLOW
1	0.00	.13	4.21	.97	.26	.39	.29	.18	1.43	.60	8.15	.45	.59	0.00	8.45	9.19	.74
2	0.00	.06	4.45	1.03	.26	.42	.30	.19	1.51	.63	8.61	.48	.62	0.00	8.86	9.71	.85
3	.50	.06	4.61	1.06	.27	.43	.31	.20	1.56	.66	8.89	.48	.65	0.00	9.67	10.02	.34
4	0.00	.06	4.86	1.12	.27	.46	.33	.21	1.65	.69	9.41	.53	.68	0.00	9.65	10.61	.96
5	0.00	0.00	4.92	1.13	.27	.46	.33	.22	1.67	.70	9.52	.53	.69	0.00	9.70	10.73	1.03
6	0.00	0.00	4.95	1.14	.27	.46	.34	.22	1.68	.70	9.58	.55	.69	0.00	9.76	10.82	1.06
7	0.00	0.00	5.01	1.16	.27	.47	.34	.22	1.70	.71	9.69	.55	.70	0.00	9.88	10.95	1.06
8	0.00	0.00	5.04	1.16	.27	.47	.34	.22	1.71	.72	9.75	.55	.71	0.00	9.94	11.01	1.07
9	0.00	0.00	5.10	1.18	.27	.48	.35	.22	2.02	.73	9.86	.55	.71	0.00	10.35	11.13	.78
10	10.00	.06	5.16	1.19	.30	.49	.35	.23	2.19	.74	9.98	.55	.72	0.00	20.71	11.25	-9.46
11	0.00	0.00	5.20	1.20	.30	.49	.35	.23	2.35	.74	10.03	.55	.73	0.00	10.85	11.31	.46
12	0.00	0.00	5.26	1.21	.30	.49	.36	.23	2.53	.75	10.20	.58	.74	0.00	11.13	11.52	.39
13	0.00	0.00	5.32	1.23	.30	.50	.36	.23	2.71	.76	10.32	.58	.74	0.00	11.40	11.64	.24
14	0.00	0.00	5.35	1.23	.30	.50	.36	.23	2.72	.76	10.37	.58	.75	0.00	11.47	11.71	.24
15	0.00	0.00	5.41	1.25	.30	.51	.37	.24	2.76	.77	10.49	.58	.76	0.00	11.60	11.83	.23
16	0.00	.06	5.47	1.26	.30	.51	.37	.24	2.79	.78	10.60	.58	.77	0.00	11.79	11.95	.16
17	0.00	0.00	5.54	1.28	.30	.52	.38	.24	2.82	.79	10.72	.61	.77	0.00	11.86	12.10	.25
18	0.00	0.00	5.57	1.28	.30	.52	.38	.24	2.84	.79	10.77	.61	.78	0.00	11.92	12.16	.24
19	0.00	0.00	5.63	1.30	.30	.53	.38	.25	2.87	.80	10.89	.61	.79	0.00	12.05	12.29	.24
20	0.00	0.00	5.69	1.31	.30	.53	.39	.25	2.90	.81	11.00	.61	.80	0.00	12.18	12.41	.23

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1.93

Table 7-6

FINANCIAL APPRAISAL OF A SHEEP PRODUCTION UNIT
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)										BENEFITS($000)				TOTALS($000)		
	INVESTMENT		OPERATING COSTS														
YEAR	BUILD EQUIP	LIVE STOCK	FEED	FERTI LIME	REPAI	SALT& MINE	MARKE TING	SHEA RING	LABOR	OTHER	LAMBS	CULLS	WOOL	INCEN TIVE	COST	BENEFIT	NETFLOW
1	0.00	.13	4.06	.97	.26	.39	.29	.18	2.38	.66	8.15	.45	.59	.30	9.32	9.49	.17
2	0.00	.06	4.30	1.03	.26	.42	.30	.19	2.52	.70	8.61	.48	.62	.20	9.78	9.91	.13
3	.50	.06	4.45	1.06	.27	.43	.31	.20	2.61	.72	8.89	.48	.65	.13	10.62	10.14	-.48
4	0.00	.06	4.69	1.12	.27	.46	.33	.21	2.75	.76	9.41	.53	.68	.20	10.65	10.81	.16
5	0.00	0.00	4.75	1.13	.27	.46	.33	.22	2.78	.77	9.52	.53	.69	.05	10.72	10.78	.07
6	0.00	0.00	4.78	1.14	.27	.46	.34	.22	2.80	.77	9.58	.55	.69	0.00	10.78	10.82	.04
7	0.00	0.00	4.84	1.16	.27	.47	.34	.22	2.84	.78	9.69	.55	.70	0.00	10.92	10.95	.03
8	0.00	0.00	4.87	1.16	.27	.47	.34	.22	2.85	.79	9.75	.55	.71	0.00	10.98	11.01	.03
9	0.00	0.00	4.93	1.18	.27	.48	.35	.22	2.89	.80	9.86	.55	.71	0.00	11.11	11.13	.02
10	10.00	.06	4.99	1.19	.30	.49	.35	.23	2.92	.81	9.98	.55	.72	0.00	21.33	11.25	-10.08
11	0.00	0.00	5.02	1.20	.30	.49	.35	.23	2.94	.81	10.03	.55	.73	0.00	11.34	11.31	-.02
12	0.00	0.00	5.08	1.21	.30	.49	.36	.23	2.98	.82	10.20	.58	.74	0.00	11.47	11.52	.05
13	0.00	0.00	5.14	1.23	.30	.50	.36	.23	3.01	.83	10.32	.58	.74	0.00	11.60	11.64	.05
14	0.00	0.00	5.17	1.23	.30	.50	.36	.23	3.03	.84	10.37	.58	.75	0.00	11.66	11.71	.04
15	0.00	0.00	5.23	1.25	.30	.51	.37	.24	3.06	.85	10.49	.58	.76	0.00	11.80	11.83	.03
16	0.00	.06	5.29	1.26	.30	.51	.37	.24	3.10	.85	10.60	.58	.77	0.00	11.99	11.95	-.04
17	0.00	0.00	5.35	1.28	.30	.52	.38	.24	3.13	.87	10.72	.61	.77	0.00	12.06	12.10	.04
18	0.00	0.00	5.38	1.28	.30	.52	.38	.24	3.15	.87	10.77	.61	.78	0.00	12.12	12.16	.04
19	0.00	0.00	5.44	1.30	.30	.53	.38	.25	3.19	.88	10.89	.61	.79	0.00	12.25	12.29	.03
20	0.00	0.00	5.50	1.31	.30	.53	.39	.25	3.22	.89	11.00	.61	.80	0.00	12.39	12.41	.02

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -3.73

7.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences underlying each of these analytical approaches are explained in detail in Chapter Two. The adjustments made to the financial variables to present the information in an economic context are as follows:

a) all indirect taxes (federal and provincial sales taxes and property taxes) have been removed;

b) the subsidy on feed grain shipments (an average of $10/tonne) has been removed and this is reflected in higher feed costs;

c) labour costs have been reduced to reflect the impact of unemployment on opportunity cost; and,

d) incentive assistance payments have been removed from the revenue side.

The effect of these adjustments is to increase the net financial present value of the project from a loss of $3,730 to a positive $1,430.

7.4.5 Sensitivity Analysis

The results of the sentivitity analysis are set out in Table 7-7.

Table 7-7

Sensitivity Analysis
Sheep Production Unit
(NPV in '000 $1978)

Variable		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
		Economic Analysis						
Discount Rate	NPV			1.65	1.93	2.05		
	BCR			1.01	1.02	1.03		
Feed Cost	NPV	8.23	6.13	4.03	1.93	(.17)	(2.27)	(4.37)
	BCR	1.10	1.07	1.05	1.02	.99	.98	.95
Fertilizer	NPV	3.38	2.90	2.42	1.93	1.45	.96	.48
	BCR	1.04	1.03	1.03	1.02	1.02	1.01	1.00
Labour	NPV	4.42	3.59	2.76	1.93	1.10	.27	(.55)
	BCR	1.05	1.04	1.03	1.02	1.01	1.00	.99
Lamb Sales	NPV	(10.26)	(6.20)	(2.13)	1.93	6.00	10.06	14.12
	BCR	.89	.93	.98	1.02	1.07	1.11	1.16

Variable		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
		Financial Analysis						
Discount Rate	NPV			(5.95)	(3.73)	(2.37)		
	BCR			.96	.96	.97		
Feed Cost	NPV	2.36	.33	(1.70)	(3.73)	(5.75)	(7.78)	(9.81)
	BCR	1.02	1.00	.98	.96	.94	.92	.90
Fertilizer	NPV	(2.27)	(2.76)	(3.24)	(3.73)	(4.21)	(4.69)	(5.18)
	BCR	.98	.97	.97	.96	.96	.95	.95
Labour	NPV	(.16)	(1.35)	(2.54)	(3.73)	(4.91)	(4.69)	(7.29)
	BCR	.99	.98	.97	.96	.95	.94	.93
Lamb Sales	NPV	(15.92)	(11.85)	(7.79)	(3.73)	.34	4.40	8.46
	BCR	.83	.88	.92	.96	1.00	1.05	1.09

Note: Figures in brackets denote negative values.

8.0 Purebred Sheep Breeding Stock Incentive

Participation in this programme has been too small and sporadic to afford any realistic information for cost-benefit analysis. The programme was intended to upgrade the quality and increase the productivity of flocks by giving assistance towards the cost of importation, transportation and quarantine. The assistance was up to $200 to any producer in any year with an overall objective of adding 500 high quality animals to provincial flocks in five years. Estimated costs were:

Federal Share	Provincial Share
$80,000	$20,000

Initially the assistance would only be paid for animals from outside Canada although this was later changed to allow for importation from other parts of Canada.

Project performance has been uneven at best. To date, 88 animals have been imported and assistance paid on 60 of these. Producers assisted were:

1976	1
1977	3
1978	2
1979	6
1980 (to date)	2

These animals came from:

	Assisted	Not Assisted
United States	34	20
Ontario	16	8
United Kingdom	9	-
British Columbia	1	-

Major breeds were Suffolk (14), Jacobs (2), Scottish Blackface (2), Dorset (5), Montadale (5), Rambouillet (1), Romney (9), Shropshire (8), Hampshire (2), Leicester (5), Finnish Landrace (1), North Country Cheviot (1), and Cluny Forest (5). There were 17 males and 43 females assisted. Total costs have been:

Transportation	$ 6,775.02
Quarantine	3,773.00
TOTAL	$10,548.02
Assistance Paid	$ 8,996.25

This represents 9 percent of estimated total cost for 12 percent of the estimated addition to breeding stock. Such small figures would probably result in spurious results if subjected to analysis aside from difficulties of specifying benefits and their incidence.

9.0 Manure Storage Incentive Programme

9.1 Sector Profile

Manure resulting from animal production can be detrimental to the environment and a hazard to the health and safety of both humans and animals. Moreover, if not properly stored, manure will lose a high proportion of its nutrient content resulting in sheer waste of a valuable replacement for, or complement of, commercial fertilizers.

Over the years, a combination of factors has inhibited the development and widespread utilization in Nova Scotia of manure management systems which are both environmentally and economically acceptable. In essence, the basis of the problem is two-fold. First, the structure of the agricultural sector with many relatively small producers has meant that, with the exception of a handful of dairy and hog producers, the magnitude of the environmental problem for any single producer has not been significant. Second, when coupled with relatively low feed grain prices and relatively low prices for fertilizer up to the early 1970's, there had been little incentive for farmers either to rely extensively on their own farms as a source of livestock feed or to use manure as a source of fertilizer for the crops which were grown.

Things have changed. Production units in the hog, dairy and beef industries are becoming larger, and, with the exception of dairy operations, are growing in numbers. Hence the sheer magnitude of the manure problem from an environmental perspective is increasing. Moreover, with rising feed and fertilizer prices and considerable uncertainty over future price increases, greater emphasis is being placed by farmers on achieving some degree of self-sufficiency in production of livestock feeds. In short, the environmental problem has become more serious and economics suggests that serious attention should be focussed on the use of manure as a fertility resource.

9.2 Project Description

9.2.1 Objectives

The Manure Storage Incentive Programme is linked directly to programmes designed to lead to an expansion of livestock numbers in the Province and, as well, is directed at replacement of existing facilities deemed inadequate for environmental or purely economic reasons. The primary objectives of this Programme are two-fold:

a) to minimize environmental damage caused by improper manure storage; and,

b) to maximize the nutritive value of animal wastes and promote their use as fertilizer.

These objectives would be achieved through construction and use of appropriate manure storage and handling systems.

Qualification for grant assistance is limited to two conditions:

a) the storage facility must be constructed to meet engineering and environmental standards; and,

b) the applicant must have a gross income exceeding $10,000 per year from the sale of agricultural products or, must obtain at least 50 percent of gross income from farming.

The scope of assistance available is limited to a grant of 50 percent of the capital cost of facilities up to a maximum of $15,000 per participant over the duration of the Programme. It was estimated that the Programme would be taken up by at least 400 farms. The estimated five-year cost of the Programme was $3.2 million to be divided as follows:

Federal Share	Provincial Share	Producers' Share
$1,280,000	$320,000	$1,600,000

9.2.2 Project Performance

The number and cost of storage units constructed under the Programme in its first four years is summarized in Table 9-1. During the first three years a total of 339 farms took advantage of the grants available with a number

Table 9-1

Manure Storage Incentive Programme
Type of Facilities and Average Unit Cost by Year

	Total Units (1)	Type of Storage System (2) Enclosed	Lagoon	Pad	Tank	Total Investment (1)	Average Investment/Unit
1976	107	26	3	64	14	378,484	3.537
1977	141	34	4	84	19	612,168	4,342
1978	206	50	5	123	28	1,050,878	5,101
1979	167	41	4	99	23	1,422,860	8,520
TOTAL	621	151	16	370	84	3,464,390	5,375

Sources:

Notes: 1. Total units constructed and total investment were obtained from the Annual Reports.

2. The breakdown by type of storage unit was based on Survey results as well as through interviews with personnel from the Department of Agriculture and Marketing.

of these participating in more than one year. Accordingly, given the 167 grants provided in the fourth year, even with a considerable number of repeating participants, the Programme would appear to have achieved its target of assisting 400 farms. As Table 9-1 indicates, the estimated cost of the Programme of $3.2 million was exceeded by over $200,000 by the end of the fourth year. It is noteworthy as well that the average cost per unit increased steadily over the years, although it is not possible from information readily available to distinguish between changes in average unit capacity and design and inflationary factors in accounting for these cost increases.

9.2.3 Participant Profile

An estimated 450 farms participated in the incentive programme over its five-year life with as many as 170 of these participating in more than one year. A profile of the average participant based on information contained in the Survey is presented in Table 9-2. This information covers the first three years of the Programme and is based on a sample of 35 producers, just over 10 percent of the total participants(339) up to that point. The information reproduced here provides a rough indication only of the average operation. For a more detailed description of participants see Sorflaten 1980.

The most significant points to note about the average participants in the manure storage programme are as follows:

a) the average cost of the facility was $8,724;
b) the farm employed 1.94 persons;
c) off-farm work was low;
d) participation was dominated by relatively large enterprises earning in excess of $75,000 annually;
e) participants were predominantly dairy farmers (21) followed by hogs (7) and beef (5) of a sample size of 35.
f) 54.8 percent of the 31 producers who responded to this question indicated they would have undertaken the project without assistance.

Table 9-2

Profile of Average Participant
Manure Storage Incentive Programme

Item	Number of Responses	Average Measure	Average Percentage
1. Age of operator	35	47.1 yrs.	
2. Type of farm: family	26		
partnership	1		
3. Total land area operated	35	534.8 acres	
4. Value of land and buildings	35	$274,628.60	
5. Value of machinery and equipment	35	$86,981.43	
6. Total cattle and calves	31	118.30 head	
7. Cows and heifers for milking	23	68.04 head	
8. Total pigs	7	1,196.14 head	
9. Sows for breeding purposes	5	98.00 head	
10. Total sheep and lambs	2	1,003.5 head	
11. Total chickens	3	55,000.0 birds	
12. Labour: Employees	18	1.94 persons	
Weeks paid labour - male	27	60.67 weeks	
female	3	41.33 weeks	
13. Off-farm work	2	34.5 days	
14. Value of products sold:			
0 - 24,999	4		12.9
25,000 - 49,999	3		9.7
50,000 - 74,999	5		16.1
75,000 and over	19		61.3

9.3 Methodology

9.3.1 Methodological Issues

In general, the method used in the cost-benefit analysis of the manure storage programme conforms to the conventional approach set out in Chapter Two. A minor departure occurs, however, in the approach taken to determine project benefits, although the underlying principle i.e., the value in the best alternative use, is the same. Value in this case is not based on a market price for manure (no market in the accepted sense of the term exists) but on its nutrient content.

Manure has value because its nutrient content is a source of fertility for crop production. The principal nutrients contained in manure are: nitrogen and organic matter (N), phosphorus (P) and potassium (K). The availability of manure means reduced reliance on chemical fertilizers. Proper storage of manure prevents the natural dissipation of its nutrient content (e.g. through leaching) and, hence, enhances its value. The basis for determining the benefit which will accrue as a result of storage is the expense foregone of purchasing chemical fertilizer with the same nutrient content.

The steps taken to quantify this benefit are as follows:

a) determine the storage capacity by type of facility;
b) allocate the capacity by type of facility to the various livestock enterprises;
c) convert the storage capacity into manure quantity by weight (ton) or volume (gallon) as appropriate per unit of capacity (cu. ft.);
d) estimate the nutrient value of manure by type of animal;
e) estimate the difference in nutrient loss between "old" storage methods and new facilities. This difference is the net gain (loss). See Table 9-3.
f) multiply the total net gain (loss) of each nutrient by the unit price of nitrogen, phosphorus and potassium to determine the total value of stored manure. See Table 9-4.

Table 9-3

Net Gain of Nutrients Due to Manure Storage Programme

	Capacity	Manure Stored	Total Nutrient ('000 lb)			Nutrient Loss ('000 lb)			Gross Gain ('000 lb)			Nutrient Loss ('000 lb)			Net Gain ('000 lb)		
	('000 cu.ft)	('000)	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
Lagoon																	
Hogs	188	1,410	77.6	25.4	45.1	62.1	20.3	36.1	15.5	5.1	9.0	42.7	12.7	18.0	(19.4)	(7.6)	(18.1)
Enclosed																	
Dairy	3,884	116	1148.4	208.8	765.6	229.7	20.9	76.6	918.7	187.9	689.0	631.6	104.4	306.2	401.9	83.5	229.6
Pad																	
Dairy	2,236	67	663.3	120.6	442.2	352.8	70.2	164.4	280.5	50.4	277.8	431.3	87.7	219.3	78.5	17.5	54.9
Beef	1,423	43	490.2	159.1	361.2	224.5	44.7	104.7	265.7	114.4	256.5	274.4	55.8	139.6	49.9	11.1	34.9
Sheep	407	12	270.0	39.6	192.2	64.2	12.8	29.9	205.8	26.8	162.3	78.4	16.0	39.8	14.2	3.2	9.9
Tank																	
Hogs	1,804	13,530	744.2	243.5	433.0	196.1	27.8	46.1	548.1	215.7	386.9	539.4	138.9	184.4	343.3	111.1	138.3
Poultry	539	4,042	529.5	117.2	165.7	58.6	8.3	13.8	470.9	108.9	151.9	161.1	41.5	55.1	102.5	33.2	41.3
TOTAL															970.9	252.1	490.8

Note: See Assumptions set out in Section 9.3.2 for an explanation of the basis for figures used in this Table.

Table 9-4

Benefits due to Manure Storage
($ 1978)

	Value[1] $/lb.	Net Gain lb.	Total Value $
Nitrogen	.368	970,900	357,291
Phosphorus	.311	252,100	78,403
Potassium	.167	490,800	81,964
TOTAL			517,658

Note: 1. The value of nutrients is based on current fertilizer prices. These prices have been increased by 15 percent to reflect the greater fertility value of manure when used with chemical fertilizers.

9.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis:

a. Storage Capacity was taken to be 10.4×10^6 cu. ft. for all facilities, based on Survey information regarding total capital costs and average cost per cu. ft.

$$\$3,500,000 \div \$.34/\text{cu.ft.} = 10.3 \text{ million cu. ft.}$$

b) Storage Capacity for Type of Facility was based on Survey information and estimated as follows:

Facility	Number	Average Size (cu. ft.)	Total Capacity (cu. ft. x 10^3)
Lagoon	12.3	15,300	188.2
Enclosed	110.3	35,216	3,884.3
Pad	270.1	15,061	4,066.5
Tank	61.3	38,226	2,343.3
TOTAL	454.0		10,482.3

c) Type of Facility by Type of Enterprise was based on Survey information and estimated as follows:

Facility	Enterprise Type	Number	Percent	Total Capacity (cu. ft. x 10^3)
Lagoon	Hogs	12.3	100	188.2
Enclosed	Dairy	110.3	100	3,884.3
Pad	Dairy	148.6	55	2,236.0
	Beef	94.5	35	1,423.5
	Sheep	27.0	10	407.0
Tank	Hogs	47.2	77	1,804.0
	Poultry	14.1	23	539.3
TOTAL		454.0		10,482.3

d) Manure Equivalent of Storage Capacity: The following factors were used to convert storage capacity into manure quantity by volume and weight:

Lagoon	188.2 x 10^3	x 7.5 gal/cu. ft.	=	1,410 x 10^3	gal
Enclosed	3,884.3 x 10^3	x 60 lbs/cu. ft.	=	116 x 10^3	tons
Pad	4,066.5 x 10^3	x 60 lbs/cu. ft.	=	122 x 10^3	tons
Tank	2,343.3 x 10^3	x 7.5 gal/cu. ft.	=	17,572 x 10^3	gal

e) Nutrient Content by Manure Type was estimated as follows:

Pounds of nutrient per 1,000 gallons

	N	P	K
Hogs	55.0	18.0	32.0
Poultry	131.0	29.0	41.0

Pounds of nutrient per ton

	N	P	K
Dairy	9.9	1.8	6.6
Beef	11.4	3.7	8.4
Sheep	22.5	3.3	16.0

f) Nutrient Prices expressed in $1978 (constant) per pound were estimated as follows:

	N		P		K	
	actual	adjusted[1]	actual	adjusted[1]	actual	adjusted[1]
1976	.230	.265	.197	.227	.099	.114
1977	.235	.270	.201	.231	.101	.116
1978	.251	.289	.215	.247	.108	.124
1979	.291	.335	.250	.288	.125	.144
1980	.320	.368	.270	.311	.145	.167

1. The fertility value of manure nutrients increases by approximately 30% when used in conjunction with chemical fertilizers. Half of this increase has been attributed here to manure and its value in terms of fertilizer displaced has been adjusted commensurately.

g) Nutrient Loss Factors: the following factors have been used to estimate the nutrient loss for old versus new storage methods:

	New				Old		
	N	P	K		N	P	K
	(Percentage)				(Percentage)		
Lagoon	80	80	80	Open	55	50	40
Enclosed	20	10	10				
Pad	45	40	30				
Tank	20	10	10				

h) Capacity Utilization: it was assumed that all facilities would be used to full storage capacity in the year of construction.

i) Operating Costs: no incremental operating costs have been included on the assumption that these costs would be approximately equal to costs which would otherwise have been incurred in transporting and spreading purchased fertilizers.

j) Other Capital Costs: with the exception of pumps (at $5,000 each) in the case of tank storage used by hog producers, no additional capital costs (e.g. tractors, spreaders) were considered necessary for facilities utilization. Given the size and type of enterprises in question (Survey information) such equipment would already have been in use.

9.4 Results

9.4.1 Cost-Benefit Analysis

The costs and benefits associated with the base case analysis of the Manure Storage Incentive Programme are set out in cash flow form in Table 9-5. The analysis indicates that the Programme will yield the following results:

Net Present Value	$533,280
Benefit-Cost Ratio	1.2

These results lead to the conclusion that the programme is worthwhile in economic terms.

9.4.2 Incrementality

The gross net present value of $533,280 cannot be attributed exclusively to incentives provided under the programme. The Survey indicates that 54.8 percent of participants would have undertaken the work without incentives. This is a reasonable estimate given the economic and environmental factors which would have entered the decision. The implication of this finding is that 45.2 percent of projects undertaken (and, assuming a direct relationship between capacity and costs and benefits) and the net present value arising therefrom are directly attributable to incentives provided under the programme. The incremental NPV is $239,976.

9.4.3 Financial Analysis

The results of the financial analysis are set out in Table 9-6. According to the base case analysis the programme would yield a net present value to participants of $1,705,100 before adjustment for incrementality.

9.4.4 Cost-Benefit vs. Financial Analysis

The differences in methodology between these two analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the fi-

Table 9-5

ECONOMIC APPRAISAL OF THE MANURE STORAGE INCENTIVE PROGRAM
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)		BENEFITS($000)		TOTALS($000)		
	INVESTMENT	OPE COST					
YEAR	STRUCTURES	OPE COST	VALUE	GRANT	COST	BENEFIT	NETFLOW
1	409.53	0.00	48.04	0.00	409.53	48.04	-361.49
2	604.50	0.00	120.74	0.00	604.50	120.74	-483.76
3	970.59	0.00	252.73	0.00	970.59	252.73	-717.86
4	1184.20	0.00	468.53	0.00	1184.20	468.53	-715.67
5	0.00	0.00	517.66	0.00	0.00	517.66	517.66
6	28.17	0.00	517.66	0.00	28.17	517.66	489.48
7	41.71	0.00	517.66	0.00	41.71	517.66	475.94
8	66.83	0.00	517.66	0.00	66.83	517.66	450.83
9	81.68	0.00	517.66	0.00	81.68	517.66	435.98
10	0.00	0.00	517.66	0.00	0.00	517.66	517.66
11	28.17	0.00	517.66	0.00	28.17	517.66	489.48
12	41.71	0.00	517.66	0.00	41.71	517.66	475.94
13	66.83	0.00	517.66	0.00	66.83	517.66	450.83
14	81.68	0.00	517.66	0.00	81.68	517.66	435.98
15	0.00	0.00	517.66	0.00	0.00	517.66	517.66
16	28.17	0.00	517.66	0.00	28.17	517.66	489.48
17	41.71	0.00	517.66	0.00	41.71	517.66	475.94
18	66.83	0.00	517.66	0.00	66.83	517.66	450.83
19	81.68	0.00	517.66	0.00	81.68	517.66	435.98
20	0.00	0.00	517.66	0.00	0.00	517.66	517.66

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 802.71

Table 9-6

FINANCIAL APPRAISAL OF THE MANURE STORAGE INCENTIVE PROGRAM
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)		BENEFITS($000)		TOTALS($000)		
	INVESTMENT	OPE COST					
YEAR	STRUCTURES	OPE COST	VALUE	GRANT	COST	BENEFIT	NETFLOW
1	474.40	0.00	48.04	221.72	474.40	269.76	-204.64
2	700.25	0.00	120.74	327.20	700.25	447.94	-252.30
3	1124.32	0.00	252.73	525.44	1124.32	778.17	-346.15
4	1371.76	0.00	468.53	641.00	1371.76	1109.53	-262.23
5	0.00	0.00	517.66	0.00	0.00	517.66	517.66
6	30.96	0.00	517.66	0.00	30.96	517.66	486.70
7	45.84	0.00	517.66	0.00	45.84	517.66	471.82
8	73.44	0.00	517.66	0.00	73.44	517.66	444.22
9	89.76	0.00	517.66	0.00	89.76	517.66	427.90
10	0.00	0.00	517.66	0.00	0.00	517.66	517.66
11	30.96	0.00	517.66	0.00	30.96	517.66	486.70
12	45.84	0.00	517.66	0.00	45.84	517.66	471.82
13	73.44	0.00	517.66	0.00	73.44	517.66	444.22
14	89.76	0.00	517.66	0.00	89.76	517.66	427.90
15	0.00	0.00	517.66	0.00	0.00	517.66	517.66
16	30.96	0.00	517.66	0.00	30.96	517.66	486.70
17	45.84	0.00	517.66	0.00	45.84	517.66	471.82
18	73.44	0.00	517.66	0.00	73.44	517.66	444.22
19	89.76	0.00	517.66	0.00	89.76	517.66	427.90
20	0.00	0.00	517.66	0.00	0.00	517.66	517.66

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1705.10

nancial variables in order to present the information in an economic context are as follows:

a) the cost of labour was reduced to reflect the impact of unemployment on opportunity cost;

b) the grants were removed since they are transfer payments only and do not reflect the actual use of resources;

The effect of these adjustments is to lower the net present value from $1,705,100 in financial terms to $533,280 in economic terms.

9.4.5 Sensitivity Analysis

The results of the sensitivity analysis are presented in Table 9-7. The results of both the cost-benefit and financial analyses are highly sensitive to the discount rate and relatively insensitive to adjustments in investment costs and the imputed value of manure.

Table 9-7

Sensitivity Analysis
Manure Storage Incentive Programme
(NPV in '000 $1978)

Variable		Cost-Benefit Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			1816.8	533.3	1.36		
	BCR			1.57	1.20	1.00		
Investment	NPV	943.3	815.4	684.6	533.3	422.9	292.1	161.2
	BCR	1.43	1.34	1.27	1.20	1.15	1.10	1.05
Revenue	NPV				533.3			
	BCR				1.20			

Variable		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			3287.7	1705.1	876.2		
	BCR			1.92	1.56	1.34		
Investment	NPV	2157.9	2007.0	1856.1	1705.1	1554.2	1403.2	1252.3
	BCR	1.84	1.74	1.65	1.56	1.49	1.42	1.36
Revenue	NPV	1192.2	1363.1	1534.1	1705.1	1876.1	2047.1	2218.0
	BCR	1.39	1.45	1.51	1.56	1.62	1.68	1.73

IV. HORTICULTURE

10.0 Tree-Fruit Incentive

10.1 Sector Profile

Nova Scotia's orchard growers have traditionally been responsible for the major agricultural export from the Province. The specialist production and processing of apples, pears and plums is estimated to account for between 10 and 15 percent of the total personal income in Kings County, the centre of the industry. Annual output varies around 2.5 million bushels, mostly apples.

There has been a trend during the 1970's to replant many older orchard-acres with higher-yielding, smaller apple trees at higher densities, in the place of older standard varieties. As these younger trees have come into production output has increased and, coincidentally, there has been a strengthening of prices. The price in 1975 ($1.22/bushel) was the only exception to this trend; a Stabilization Plan was put into effect to assist apple growers in that year. The prices for pears and plums have similarly increased during the 1980's (from $1.92 a bushel in 1971 to $4.70 a bushel in 1978 for pears, and from $3.25 a bushel in 1971 to $6.50 a bushel for plums) but production is small compared with apples.

Apples are sold mainly to processors although there has been an increasing demand in recent years for fresh fruit within Nova Scotia (Table 10-2). There are significant time lags facing a producer after planting an apple tree. First yields can be expected after 5 years and peak yields not before 11 years. These peaks will be sustained fairly well up to 30 years. The grower must balance his replanting programme to allow for no production for some trees, therefore, for at least 5 years while allowing for a continued cash flow to finance replanting and expansion.

Table 10-1

Production and Prices of Apples in Nova Scotia 1961 - 1978

	Production ('000 bu.)	Price ($/bu.)
1978	2,700	2.52
1977	2,200	2.36
1976	2,250	2.37
1975	2,600	1.22
1974	2,250	1.96
1973	2,200	2.59
1972	1,950	1.59
1971	2,550	.87
1966	2,962	1.07
1961	2,151	.94

Source: Nova Scotia Department of Agriculture and Marketing, Agricultural Statistics 1978, Table 46.

Table 10-2

Disposition of Apple Crop, Nova Scotia
1961 - 1978

	Production ('000 bu.)	Export ('000 bu.)	Export (% of Crop)	Processed ('000 bu.)	Processed (% of Crop)	Fresh Crop Canada ('000 bu.)	Fresh Crop Canada (% of Crop)
1978	2,700	126	4.7	1,634	60.5	940	34.8
1977	2,200	118	5.4	1,282	58.3	800	36.3
1976	2,250	90	4.0	1,245	55.3	915	40.7
1975	2,600	134	5.2	1,594	61.3	872	33.5
1974	2,250	61	2.7	1,453	64.6	736	32.7
1973	2,200	114	5.2	1,173	53.3	913	41.5
1972	1,950	145	7.4	1,192	61.1	613	31.4
1971	2,550	161	6.3	1,152	60.9	837	32.8
1966	2,962	257	8.7	2,095	70.7	610	20.6
1961	3,151	638	20.2	1,921	61.0	592	18.8

Source: Nova Scotia Department of Agriculture and Marketing, Agricultural Statistics 1978, Table 49.

10.2 Project Description

10.2.1 Objectives

The major market for Nova Scotia tree fruit is regional, within the Atlantic Provinces. Approximately 60 percent of fresh apples within the Atlantic Region come from Nova Scotia with the remainder coming from New Brunswick, Quebec, British Columbia and as far afield as South Africa and New Zealand. There is, therefore, potential for expansion in the varieties of apples particularly which are grown in Nova Scotia.

The major aim of the incentive, though, was to expedite the replacement of older trees bearing less than desirable varieties; it was, therefore, a revitalization programme of the production sector.

The incentive was offered at $2 per new planting to a maximum of 25 acres plus one acre for each 10 established acres thereafter. Assistance to any grower could not exceed $1,000 per acre. To qualify, a grower must already have 5 acres of tree fruits. The overall objective was to plant 250,000 trees over 5 years.

The estimated five-year cost of the programme was $500,000 to be divided as follows:

Federal Share	Provincial Share
$400,000	$100,000

10.2.2 Project Performance

Table 10-3 summarizes the overall performance of the incentive during its first four years of operation. Participation in the project has been good and consistent. By 1979 $415,532 of the allocation had been taken up for total plantings of 206,751 trees. By the expiration of the programme the objectives should almost have been achieved. A stable core of about 95 eligible growers seems responsible for taking up the programme and the rate at which it has been taken up has increased year by year. Indications are that uncertainty about the course of events after the incentive ends will lead to sharply reduced plantings.

Table 10-3

Tree Fruit Incentive

	1976	1977	1978	1979	1976-79
Number of trees planted	40,401	47,317	50,670	68,363	206,751
% apples	83	86	85	92	87
pears	7	8	6	5	6
plums	4	3	4	1	3
peaches	2	1	4	2	3
cherries	2	1	1	(a)	1
Total Assistance ($)[b]	81,934	93,791	103,081	136,726	415,532
Number of Participants	94	95	95	95	379
Trees/participant	430	498	533	720	2,181
Average Acres of new plantings[c]	2.8	3.2	3.4	4.6	14

Source: Annual Reports, 1976-79.

Notes: (a) less than 0.5 percent
(b) includes monitoring costs for 1976, 1977 and 1978
(c) at 155 trees per acre.

As might be expected major interest in the programme has come from Hants, Kings and Annapolis counties.

10.2.3 Participant Profile

No survey data are available of the average participant in the programme. It may indeed be misleading in the extreme to assume that such a concept as "the average" fruit grower exists except as a statistical abstraction. The annual apple enterprise study conducted by Agricultural Canada indicates an average size of orchard under apples (from a sample of 7 growers) of 65 acres of which 41 are in production, 5 acres of pears and 2 acres of other fruits for a total of 72 acres. There is normally some income from other agricultural enterprises such as livestock but this tends to be secondary to the orchard operation.

10.3 Methodology

10.3.1 Methodological Issues

The format of the Cost-Benefit Analysis outlined in Chapter Two is adapted in two major aspects for the Tree Fruit Incentive.

a) A project period of 30 years forms the basis of all projections to allow for the maturing and production of apple trees planted during the incentive;

b) The projections are done twice, once with assumptions surrounding the incentive programme, the second time assuming no incentive was in place.

In addition the analysis deals only with costs and benefits of the incremental plantings of apple trees rather than modelling the entire orchard, which would require a more extensive analysis over a much longer life-span of the trees.

10.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis:

a) With No Incentive: a viable apple orchard operation with a pre-determined replanting and expansion strategy of one acre of replanting alternating annually with one acre of expansion.

With the Incentive: a viable apple orchard operation where the pre-determined replanting and expansion strategy is accelerated during the five years of the incentive to a combined replanting/expansion of:

Year 1	3 acres
Year 2	3 acres
Year 3	4 acres
Year 4	4 acres
Year 5	4 acres

After year 5 (end of incentive) the "no incentive" pattern is resumed. In both cases it is assumed there is sufficient acreage of older trees to supply "replantings." New plantings take place on land previously cleared and used for grain cultivation and owned by the orchardist.

b) Yields: were based on the 115th Annual Report of the Nova Scotia Fruit Growers' Association (1978) and are assumed to be:

Year 1 to Year 5	- No yield
Year 6 to Year 11	- 420 bushels/acre
Year 12 to Year 30	- 760 bushels/acre
Year 31 to replanting	- 350 bushels/acre

New trees are planted at a density of 155/acre.

c) Capital costs: were estimated as follows:

i) Building, vehicles and equipment

Year 5 - $4,000
Year 10 - $1,000
Year 15 - $4,000
Year 25 - $4,000

ii) Land Clearing and Improvement

Clearing - $100/acre
Improvement - $215/acre

iii) Opportunity costs of new expansion

Income from grain foregone - $100/acre

iv) Opportunity costs of lost production because of accelerated replacement taking trees out of production before productive life is over (or opportunity cost has reached zero)

$2.59/bushel of cumulative lost output in years 1-9

v) New trees

$3 each

d) Operating Expenses for Producing Trees: include labour (pruning and picking), spray materials, fertilizer and lime, container and bin purchase and rental, general orchard expenses, building repairs, vehicle and equipment expenses, utilities and insurance, and miscellaneous, were derived from the Nova Scotia Apple Enterprise Study for 1978, and are $2.09/bushel.

e) Operating expenses for Non-Producing Trees: computed as $30.60/acre.

Revenues: are 2.59/bushel (1978 average price).

10.4 Results

10.4.1 Cost-Benefit Analysis

The costs and benefits of expanding an apple orchard both with and without the incentive are set out in cash flow terms in Tables 10-4 and 10-5. This indicates that the base case project will yield the following results:

	With Incentive	Without Incentive
Net Present Value	($14,430)	($710)
Benefit-Cost Ratio	.91	.99

These results are for a single enterprise. Over the first four years of the programme an estimated 95 individual growers took up the incentive; for the programme as a whole, therefore, the results will be:

	With Incentive	Without Incentive
Net Present Value	($1,370,850)	($67,450)
Benefit-Cost Ratio	.91	.99

This shows that over the 30 year project period the programme has not been profitable in the larger sense. Significant losses incurred during initial years of the project, mainly because of lost output from prematurely cleared trees and extra land-clearing and preparation costs. These extra costs are not offset by increased output over 30 years although they probably would be recouped with more production time. The programme as well is very sensitive to discount rate changes; for the economic appraisal, a 5 percent discount results in a net present value of $ 11,720 for a single enterprise which becomes the above-mentioned loss of $ 14,430 at a 10 percent discount rate.

10.4.2 Incrementality

The gross net present value of a $ 1,370,850 loss over the 30 years is probably not solely attributable to the programme. There are, however, no

Table 10-4

ECONOMIC APPRAISAL OF APPLE ORCHARD EXPANSION UNDER TREE FRUIT INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)							BENEFITS($000)		TOTALS($000)		
	INVESTMENT					OPE. COSTS						
	BUILD EQUIP	LAND	OPP. COST	LOST OUT.	NEW TREES	NO PR TREES	PRODU TREES	SALES	INCENTIVE	COST	BENEFIT	NETFLOW
1	0.00	.85	.10	.91	1.40	.08	0.00	0.00	0.00	3.33	0.00	-3.33
2	0.00	.85	.20	1.81	1.40	.16	0.00	0.00	0.00	4.41	0.00	-4.41
3	0.00	1.16	.30	3.63	1.86	.26	0.00	0.00	0.00	7.21	0.00	-7.21
4	0.00	1.16	.40	5.44	1.86	.37	0.00	0.00	0.00	9.23	0.00	-9.23
5	4.00	1.16	.50	7.25	1.86	.48	0.00	0.00	0.00	15.25	0.00	-15.25
6	0.00	.22	.60	6.35	.47	.42	0.00	0.00	0.00	8.05	0.00	-8.05
7	0.00	.32	.60	5.44	.47	.37	.76	1.09	0.00	7.95	1.09	-6.86
8	0.00	.22	.70	3.63	.47	.29	5.06	7.25	0.00	10.35	7.25	-3.10
9	0.00	.32	.70	1.81	.47	.22	9.72	13.42	0.00	13.23	13.42	.18
10	1.00	.22	.80	0.00	.47	.14	14.46	19.58	0.00	17.08	19.58	2.50
11	0.00	.32	.80	0.00	.47	.14	15.54	20.67	0.00	17.27	20.67	3.40
12	0.00	.22	.90	0.00	.47	.15	18.68	24.40	0.00	20.41	24.40	3.99
13	0.00	.32	.90	0.00	.47	.15	21.93	28.13	0.00	23.75	28.13	4.37
14	0.00	.22	1.00	0.00	.47	.15	25.52	32.74	0.00	27.35	32.74	5.39
15	4.00	.32	1.00	0.00	.47	.15	29.11	37.35	0.00	35.04	37.35	2.31
16	0.00	.22	1.10	0.00	.47	.15	33.07	42.42	0.00	35.00	42.42	7.43
17	0.00	.32	1.10	0.00	.47	.15	34.24	43.93	0.00	36.27	43.93	7.66
18	0.00	.22	1.20	0.00	.47	.15	35.78	45.89	0.00	37.80	45.89	8.09
19	0.00	.32	1.20	0.00	.47	.15	37.31	47.86	0.00	39.44	47.86	8.43
20	0.00	.22	1.30	0.00	.47	.15	38.84	49.83	0.00	40.97	49.83	8.85
21	0.00	.32	1.30	0.00	.47	.15	42.00	51.80	0.00	44.23	51.80	7.57
22	0.00	.22	1.40	0.00	.47	.15	42.06	53.77	0.00	44.29	53.77	9.48
23	0.00	.32	1.40	0.00	.47	.15	43.61	55.74	0.00	45.94	55.74	9.80
24	0.00	.22	1.50	0.00	.47	.15	45.16	57.71	0.00	47.49	57.71	10.22
25	4.00	.32	1.50	0.00	.47	.15	46.71	59.67	0.00	53.14	59.67	6.54
26	0.00	.22	1.60	0.00	.47	.15	48.21	61.64	0.00	50.63	61.64	11.01
27	0.00	.32	1.60	0.00	.47	.15	49.73	63.61	0.00	52.26	63.61	11.35
28	0.00	.22	1.70	0.00	.47	.15	51.26	65.58	0.00	53.79	65.58	11.79
29	0.00	.32	1.70	0.00	.47	.15	52.84	67.55	0.00	55.46	67.55	12.08
30	1.00	.22	1.80	0.00	.47	.15	55.02	69.52	0.00	58.65	69.52	10.87

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -14.43

Table 10-5

ECONOMIC APPRAISAL OF APPLE ORCHARD EXPANSION WITHOUT TREE FRUIT INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)						BENEFITS($000)		TOTALS($000)		
	INVESTMENT			OPE. COSTS							
	BUILD EQUIP	LAND	OPP. COST	NEW TREES	NO PR TREES	PRODU TREES	SALES	INCEN TIVE	COST	BENEFIT	NETFLOW
1	0.00	.32	0.00	.47	.03	0.00	0.00	0.00	.81	0.00	-.81
2	0.00	.22	.10	.47	.05	0.00	0.00	0.00	.83	0.00	-.83
3	0.00	.32	.10	.47	.08	0.00	0.00	0.00	.96	0.00	-.96
4	0.00	.22	.20	.47	.11	0.00	0.00	0.00	.99	0.00	-.99
5	4.00	.32	.20	.47	.13	0.00	0.00	0.00	5.11	0.00	-5.11
6	0.00	.22	.30	.47	.13	.76	1.09	0.00	1.87	1.09	-.78
7	0.00	.32	.30	.47	.13	1.52	2.18	0.00	2.73	2.18	-.55
8	0.00	.22	.40	.47	.13	2.28	3.26	0.00	3.49	3.26	-.22
9	0.00	.32	.40	.47	.14	3.15	4.35	0.00	4.47	4.35	-.12
10	1.00	.22	.50	.47	.14	4.02	5.44	0.00	6.34	5.44	-.90
11	0.00	.32	.50	.47	.14	4.91	6.53	0.00	6.33	6.53	.20
12	0.00	.22	.60	.47	.15	6.51	8.50	0.00	7.93	8.50	.56
13	0.00	.32	.60	.47	.15	7.75	9.95	0.00	9.28	9.95	.67
14	0.00	.22	.70	.47	.15	9.69	12.43	0.00	11.22	12.43	1.21
15	4.00	.32	.70	.47	.15	11.22	14.40	0.00	16.85	14.40	-2.45
16	0.00	.22	.80	.47	.15	12.76	16.37	0.00	14.39	16.37	1.98
17	0.00	.32	.80	.47	.15	14.29	18.34	0.00	16.02	18.34	2.32
18	0.00	.22	.90	.47	.15	15.83	20.31	0.00	17.56	20.31	2.75
19	0.00	.32	.90	.47	.15	17.36	22.27	0.00	19.19	22.27	3.08
20	0.00	.22	1.00	.47	.15	18.90	24.24	0.00	20.73	24.24	3.52
21	0.00	.32	1.00	.47	.15	21.37	26.21	0.00	23.31	26.21	2.90
22	0.00	.22	1.10	.47	.15	22.44	28.18	0.00	24.37	28.18	3.81
23	0.00	.32	1.10	.47	.15	24.03	30.15	0.00	26.06	30.15	4.08
24	0.00	.22	1.20	.47	.15	25.63	32.12	0.00	27.66	32.12	4.46
25	4.00	.32	1.20	.47	.15	27.22	34.08	0.00	33.36	34.08	.73
26	0.00	.22	1.30	.47	.15	28.69	36.05	0.00	30.82	36.05	5.24
27	0.00	.32	1.30	.47	.15	30.37	38.02	0.00	32.60	38.02	5.42
28	0.00	.22	1.40	.47	.15	31.96	40.25	0.00	34.19	40.25	6.06
29	0.00	.32	1.40	.47	.15	32.86	41.96	0.00	35.19	41.96	6.77
30	1.00	.22	1.50	.47	.15	33.82	43.93	0.00	37.15	43.93	6.78

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -.71

survey data for this incentive although indications are that there was a definite acceleration in the rates of replanting over the five years of the programme.

10.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the individual producer actually taking the investment. The results under this approach are set out in Tables 10-6 and 10-7. The net present values for the base case are as follows:

	With Incentive	Without Incentive
Net Present Value	($15.620)	($2,820)
Benefit-Cost Ratio	.91	.96

10.4.4 Cost-Benefit vs. Financial Analysis

The concepts and methods behind each of these analyses are explained in detail in Chapter Two. Adjustments made to financial variables to present the information in an economic context are as follows:

a) labour costs have been reduced to reflect the impact of unemployment on opportunity cost; and,

b) incentive assistance payments have been excluded.

10.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Table 10-8 and Table 10-9.

Table 10-6

FINANCIAL APPRAISAL OF APPLE ORCHARD EXPANSION UNDER TREE FRUIT INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)							BENEFITS($000)		TOTALS($000)		
	INVESTMENT					OPE. COSTS						
	BUILD EQUIP	LAND	OPP. COST	LOST OUT.	NEW TREES	NO PR TREES	PRODU TREES	SALES	INCEN TIVE	COST	BENEFIT	NETFLOW
1	0.00	.85	.10	.91	1.40	.09	0.00	0.00	.93	3.34	.93	-2.41
2	0.00	.85	.20	1.81	1.40	.18	0.00	0.00	.93	4.44	.93	-3.51
3	0.00	1.16	.30	3.63	1.86	.31	0.00	0.00	1.24	7.25	1.24	-6.01
4	0.00	1.16	.40	5.44	1.86	.43	0.00	0.00	1.24	9.29	1.24	-8.05
5	4.00	1.16	.50	7.25	1.86	.55	0.00	0.00	1.24	15.32	1.24	-14.08
6	0.00	.22	.60	6.35	.47	.49	0.00	0.00	0.00	8.12	0.00	-8.12
7	0.00	.32	.60	5.44	.47	.43	.88	1.09	0.00	8.13	1.09	-7.04
8	0.00	.22	.70	3.63	.47	.34	5.85	7.25	0.00	11.19	7.25	-3.94
9	0.00	.32	.70	1.81	.47	.24	10.83	13.42	0.00	14.36	13.42	-.95
10	1.00	.22	.80	0.00	.47	.15	15.80	19.58	0.00	18.43	19.58	1.15
11	0.00	.32	.80	0.00	.47	.15	16.68	20.67	0.00	18.41	20.67	2.26
12	0.00	.22	.90	0.00	.47	.15	19.69	24.40	0.00	21.42	24.40	2.98
13	0.00	.32	.90	0.00	.47	.15	22.70	28.13	0.00	24.53	28.13	3.60
14	0.00	.22	1.00	0.00	.47	.15	26.42	32.74	0.00	28.25	32.74	4.49
15	4.00	.32	1.00	0.00	.47	.15	30.14	37.35	0.00	36.07	37.35	1.28
16	0.00	.22	1.10	0.00	.47	.15	34.23	42.42	0.00	36.17	42.42	6.26
17	0.00	.32	1.10	0.00	.47	.15	35.45	43.93	0.00	37.48	43.93	6.45
18	0.00	.22	1.20	0.00	.47	.15	37.03	45.89	0.00	39.07	45.89	6.83
19	0.00	.32	1.20	0.00	.47	.15	38.62	47.86	0.00	40.76	47.86	7.11
20	0.00	.22	1.30	0.00	.47	.15	40.21	49.83	0.00	42.34	49.83	7.49
21	0.00	.32	1.30	0.00	.47	.15	41.80	51.80	0.00	44.03	51.80	7.77
22	0.00	.22	1.40	0.00	.47	.15	43.39	53.77	0.00	45.62	53.77	8.15
23	0.00	.32	1.40	0.00	.47	.15	44.98	55.74	0.00	47.31	55.74	8.43
24	0.00	.22	1.50	0.00	.47	.15	46.57	57.71	0.00	48.90	57.71	8.81
25	4.00	.32	1.50	0.00	.47	.15	48.15	59.67	0.00	54.59	59.67	5.09
26	0.00	.22	1.60	0.00	.47	.15	49.74	61.64	0.00	52.18	61.64	9.47
27	0.00	.32	1.60	0.00	.47	.15	51.33	63.61	0.00	53.86	63.61	9.75
28	0.00	.22	1.70	0.00	.47	.15	52.92	65.58	0.00	55.45	65.58	10.13
29	0.00	.32	1.70	0.00	.47	.15	54.51	67.55	0.00	57.14	67.55	10.41
30	1.00	.22	1.80	0.00	.47	.15	56.10	69.52	0.00	59.73	69.52	9.79

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -15.62

Table 10-7

FINANCIAL APPRAISAL OF APPLE ORCHARD EXPANSION WITHOUT TREE FRUIT INCENTIVE
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)						BENEFITS($000)		TOTALS($000)		
	INVESTMENT			OPE. COSTS							
	BUILD EQUIP	LAND	OPP. COST	NEW TREES	NO PR TREES	PRODU TREES	SALES	INCEN TIVE	COST	BENEFIT	NETFLOW
1	0.00	.32	0.00	.47	.03	0.00	0.00	0.00	.81	0.00	-.81
2	0.00	.22	.10	.47	.06	0.00	0.00	0.00	.84	0.00	-.84
3	0.00	.32	.10	.47	.09	0.00	0.00	0.00	.97	0.00	-.97
4	0.00	.22	.20	.47	.12	0.00	0.00	0.00	1.00	0.00	-1.00
5	4.00	.32	.20	.47	.15	0.00	0.00	0.00	5.13	0.00	-5.13
6	0.00	.22	.30	.47	.15	.88	1.09	0.00	2.01	1.09	-.92
7	0.00	.32	.30	.47	.15	1.76	2.18	0.00	2.99	2.18	-.81
8	0.00	.22	.40	.47	.15	2.63	3.26	0.00	3.87	3.26	-.60
9	0.00	.32	.40	.47	.15	3.51	4.35	0.00	4.84	4.35	-.49
10	1.00	.22	.50	.47	.15	4.39	5.44	0.00	6.72	5.44	-1.28
11	0.00	.32	.50	.47	.15	5.27	6.53	0.00	6.70	6.53	-.17
12	0.00	.22	.60	.47	.15	6.86	8.50	0.00	8.29	8.50	.21
13	0.00	.32	.60	.47	.15	8.03	9.95	0.00	9.56	9.95	.39
14	0.00	.22	.70	.47	.15	10.03	12.43	0.00	11.57	12.43	.87
15	4.00	.32	.70	.47	.15	11.62	14.40	0.00	17.25	14.40	-2.85
16	0.00	.22	.80	.47	.15	13.21	16.37	0.00	14.84	16.37	1.53
17	0.00	.32	.80	.47	.15	14.80	18.34	0.00	16.53	18.34	1.81
18	0.00	.22	.90	.47	.15	16.39	20.31	0.00	18.12	20.31	2.19
19	0.00	.32	.90	.47	.15	17.97	22.27	0.00	19.81	22.27	2.47
20	0.00	.22	1.00	.47	.15	19.56	24.24	0.00	21.40	24.24	2.85
21	0.00	.32	1.00	.47	.15	21.15	26.21	0.00	23.08	26.21	3.13
22	0.00	.22	1.10	.47	.15	22.74	28.18	0.00	24.67	28.18	3.51
23	0.00	.32	1.10	.47	.15	24.33	30.15	0.00	26.36	30.15	3.79
24	0.00	.22	1.20	.47	.15	25.92	32.12	0.00	27.95	32.12	4.17
25	4.00	.32	1.20	.47	.15	27.50	34.08	0.00	33.64	34.08	.45
26	0.00	.22	1.30	.47	.15	29.09	36.05	0.00	31.23	36.05	4.83
27	0.00	.32	1.30	.47	.15	30.83	38.02	0.00	33.07	38.02	4.95
28	0.00	.22	1.40	.47	.15	32.48	40.25	0.00	34.71	40.25	5.54
29	0.00	.32	1.40	.47	.15	33.86	41.96	0.00	36.19	41.96	5.77
30	1.00	.22	1.50	.47	.15	35.45	43.93	0.00	38.78	43.93	5.15

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -2.82

Table 10-8

Sensitivity Analysis
Apple Orchard Expansion under Tree Fruit Incentive
(NPV in '000 $1978)

Variables		Economic Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			11.72	(14.43)	(20.75)		
	BCR			1.03	.91	.77		
Non-Producing Trees	NPV	(14.11)	(14.21)	(14.32)	(14.43)	(14.54)	(14.64)	(14.75)
	BCR	(.92)	.92	.91	.91	.91	.91	.91
Producing Trees	NPV	3.37	(2.56)	(8.50)	(14.43)	(20.36)	(26.29)	(32.23)
	BCR	1.02	.98	.95	.91	.88	.85	.83
Sales	NPV							
	BCR							

Variables		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			5.16	(15.62)	(19.94)		
	BCR			1.01	.91	.79		
Non-Producing Trees	NPV	(15.25)	(15.37)	(15.49)	(15.62)	(15.74)	(15.86)	(15.98)
	BCR	.91	.91	.91	.91	.91	.91	.91
Producing Trees	NPV	2.94	(3.24)	(9.43)	(15.62)	(21.80)	(27.99)	(34.17)
	BCR	1.02	.98	.94	.91	.88	.85	.82

Note: Figures in brackets denote negative values.

Table 10-9

Sensitivity Analysis
Apple Orchard Expansion Without the Incentive
(NPV in '000 $1978)

Variables		Economic Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			9.85	(.71)	(3.46)		
	BCR			1.06	.99	.90		
Non-Producing Trees	NPV	(.55)	(.60)	(.65)	(.71)	(.76)	(.82)	(.87)
	BCR	.99	.99	.99	.99	.99	.99	.99
Producing Trees	NPV	7.53	4.78	2.04	(.71)	(3.46)	(6.20)	(8.95)
	BCR	1.12	1.07	1.03	.99	.95	.92	.89
Sales	NPV	(11.29)	(7.76)	(4.24)	(.71)	2.82	6.34	9.87
	BCR	.84	.89	.94	.99	1.04	1.09	1.14

Variables		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			5.40	(2.82)	(4.60)		
	BCR			1.03	.96	.87		
Non-Producing Trees	NPV	(2.64)	(2.70)	(2.76)	(2.82)	(2.88)	(2.94)	(3.00)
	BCR	.96	.96	.96	.96	.96	.96	.96
Producing Trees	NPV	5.72	2.87	.05	(2.82)	(5.67)	(8.51)	(11.36)
	BCR	1.08	1.04	1.00	.96	.93	.89	.86
Sales	NPV	(13.40)	(9.87)	(6.35)	(2.82)	.71	4.23	7.76
	BCR	.82	.87	.91	.96	1.00	1.06	1.10

Note: Figures in brackets denote negative values

11.0 Bulk Bin Construction Programme

11.1 Sector Profile

Prior to the mid to late 1950's, Nova Scotian tree fruit and vegetable producers handled and stored their produce in bushel boxes. Developments occurred which led to the adoption of bulk bins as a means for handling produce. These bins have a capacity of seventeen bushels. By 1961-62 there was approximately an 80 percent utilization rate of bulk bins by Nova Scotian tree fruit and vegetable producers. These bins enabled the producer to handle and store his produce more efficiently.

Bulk bins are not a new innovation and their use is very widespread. However, the bins which came into use in the early 1960's have been rapidly going out of use and in need of replacement. Taking this into account and the fact that Nova Scotia's tree fruit production has been expanding, a need for more bulk bin construction has been identified.

11.2 Project Description

11.2.1 Objectives

The purpose of the Bulk Bin Construction Programme is to assist commercial tree fruit and vegetable producers to construct bulk bins for the transport or storage of fresh fruit and vegetables and, thereby, improve handling and storage efficiency and product quality.

The specific objective of this Programme is to construct 75,000 bulk bins over the five year duration of the Subsidiary Agreement.

Eligibility for assistance is determined on an individual basis by the Nova Scotia Department of Agriculture and Marketing who retain the right to reassess eligibility at any time. However, it is stated that applicants must be engaged in production of one or more of the following:

a) apples
b) pears
c) potatoes
d) cabbage
e) turnips
f) parsnips
g) beets
h) carrots
i) onions
j) cauliflower
k) squash
l) pumpkin

The assistance made available is on the basis of $10 per bin whether constructed by the applicant or purchased as newly constructed bins with a minimum of 25 bins per year. These bins have an average cost of $25.00 per bin. Applicants may apply for assistance on the construction of new bins on the basis of 15 bins per producing acre. The maximum grant is $3,000 per year to a total grant of $14,000 per farm over the duration of the Programme.

The estimated five year cost of the Programme was $1.875 million to be divided as follows:

Federal Share	Provincial Share	Producers' Share
$600,000	$150,000	$1,125,000

The number of bulk bins constructed, and costs incurred by Government over the first four years of the Programme are summarized in Table 11-1. Also from Table 11-1 it can be seen that 58,875 bulk bins have been constructed over the first four years. This represents a 78.5 percent completion of the stated five year target. This figure may have been even higher had it not been for a lumber shortage in 1978. However, even without taking this into consideration it would appear that after five years the Programme will have met its objective or just fall slightly short.

Total Programme expenditures over the first four years amounted to approximately $619,194 with $30,444 attributed to inspection, monitoring, and evaluation costs, and the remaining $488,750 applied directly to bulk bin construction.

Table 11-1

Bulk Bin Construction Programme
Bulk Bins Constructed and Government Expenditures
1976 - 1979

	Number of Bins Constructed	Grants
1976	14,129	$141,290
1977	14,904	149,040
1978	14,846	148,460
1979	14,996	149,960
TOTAL	58,875	$588,750

Inspection, Monitoring and Evaluation Costs

1976	$ 7,603
1977	7,636
1978	7,505
1979[1]	7,700
	$30,444

Total Programme Expenditure: $619,194

Source: Annual Reports.

Notes: 1. 1979 Inspection, Monitoring and Evaluation costs estimated.

11.2.3 Participant Profile

No survey information is available on the Bulk Bin Construction Programme. However, the Annual Reports do shed some light on the participants in the Programme.

Table 11-2 indicates that of the 58,875 bulk bins constructed, 93.2 percent of them were consigned for use in Kings County. This information suggests that the majority of bulk bins are used for tree fruit production, apples in particular.

The nature of the Bulk Bin Construction Programme is such that it encouraged repeat participants. The 1978 Annual Report states that in the first three years of the Programme, 123 growers participated, 30 of whom participated every year. However, only 5 of these repeat participants used the maximum grant each year.

In the 1976 Annual Report it is noted that 31 percent of the applicants in that year had no bulk bins on their farms prior to the Programme. The 1976 Annual Report also states that farms with under $10,000 gross farm income had constructed in excess of 300 percent more bins than were present on the farm at the time of application. It appears that the Programme was successful in reaching a large target audience. From the Annual Reports it is also evident that processors as well as producers are constructing bulk bins. It is estimated that between 36-40 percent of the bulk bins are being constructed by processors. Presumably these would be made available to producers by sale or rental arrangements.

Table 11-2

Bulk Bin Construction Programme
Bulk Bins Constructed by County[1]
1976 - 1979

	Number of Bins Constructed	%
Annapolis	1,297	2.2
Cumberland	1,051	1.8
Halifax	50	-
Hants	1,038	1.8
Kings	54,859	93.2
Lunenburg	380	.6
Pictou	200	.3
TOTAL	58,875	100.0

Source: Annual Reports.

11.3 Methodology

11.3.1 Methodological Issues

In general, the method used in the Cost-Benefit Analysis of the Bulk Bin Construction Programme adheres to the approach outlined in Chapter Two. The incremental capital and operating costs and revenues were estimated using historical data and by simulating the cost advantages of using bulk bins over bushel boxes for handling the output of 1 acre of orchard. A twenty-year evaluation period was employed. The results of the analysis were generalized to all participating producers and an adjustment made for incrementality in order to assess the performance of the overall programme.

11.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis:

a) Unit Size: all cost and benefit estimates are based on the production of 300 bushels of apples from 1 acre of orchard.

b) Base Year: all cost and benefit estimates are expressed in 1978 constant dollars.

c) Number of containers: Standard industry practice involves the usage of 15 bulk bins per acre. Therefore, it was assumed that 15 bins were utilized to handle 300 bushels of apples.
It is assumed that 300 bushel boxes would be used.

d) Investment:

i) Containers: this column was designed to reflect the cost saving of constructing bulk bins over bushel boxes. In essence, this item is treated as a negative cost or a benefit. Bulk bins were assumed to cost $25.00 per bin and bushel boxes were priced at $2.40 a box in 1978 prices. These cost figures were derived from the Annual Reports in the case of bulk bins, and from interviews with Department personnel for bushel boxes. Requirements for 300 bushels of apples were assumed to be:

bulk bins - 15 bins x $25 = $375
bushel boxes - 300 boxes x $2.40 = $720

Investment savings: 720 - 375 = $345/300 bushels

e) Benefits: benefits, from a revenue perspective, were assessed according to the relative amounts of bruising which occurred when apples were handled by either bulk bins or bushel boxes. It has been cited that handling with bulk bins reduces bruising by 15 percent. It was assumed that this bruising factor would affect the disposition of apples going to fresh or processing ends by a proportional amount.

Processed and fresh sales accounted for 95.3 percent of the 1978 apple crop. By converting this to a base of 100 percent the following is obtained:

processed	63.5%
fresh	36.5%
	100.0%

It was assumed that this disposition held for handling apples with bulk bins. In the case of handling apples with bushel boxes it was assumed that the 15 percent more bruising would result in a greater share of the crop going to processing. Handling with bushel boxes resulted in the following disposition:

processed	78.5%
fresh	21.5%
	100.0%

In order to quantify this change in crop disposition it was necessary to attach some value to the crop.

processed @ \$1.88/bushel
fresh @ \$4.00/bushel

It was assumed that the value difference, implied by the alternative crop dispositions, would be attributed as a benefit to using bulk bins.

i) Fresh: this column was derived to indicate the greater proportion of the crop going to fresh sales in the case of bulk bins. An incremental benefit of \$180 was realized due to handling by bulk bins.

ii) Processed: similarly, this column was designed to reflect the relative proportion of the crop going to processed sales in both handling systems. A loss of \$80 was realized due to the larger amount of bushel box handled apples going to processing sales.

iii) Subsidy: a subsidy of \$10.00 per bulk bin was paid in year 1.

f) Salvage value: no salvage value was assumed.

g) Labour and Materials: although not explicitly spelled out in the Cost-Benefit Analysis the amount of labour and materials involved in the construction of bulk bins and bushel boxes were assumed to be as follows:

i) Bulk bins:

labour	4.50	18%
materials	20.50	82%
	25.00	100%

ii) Bushel boxes:

labour	1.20	50%
materials	1.20	50%
	2.40	100%

11.4 Results

11.4.1 Cost-Benefit Analysis

The costs and benefits of the base case Bulk Bins vs. Bushel Apple Boxes are set out in cash flow form in Table 11-3. The analysis indicates that the savings accrued in the use of bulk bins as opposed to bushel boxes over the twenty year evaluation period will be:

Net Present Value	$1,140
Benefit-Cost Ratio	2.47

The base case shows the cost savings of using bulk bins over bushel boxes for 1 acre of apple orchard. Since 15 bulk bins are utilized per acre this result can be scaled up to the total project level. We estimate that over the first four years of the programme 3,925 acre equivalents of bulk bins have been constructed. The cost savings of bulk bins over bushel boxes, for the total programme are as follows:

Net Present Value	$4,474,500
Benefit-Cost Ratio	2.47

The results indicate that from the perspective of society as a whole, the programme to date has been worthwhile.

It is important to note, again, that it is not possible to compare the NPV's and BCR's across projects. The scale of the project and the assumptions concerning costs and benefits make this sort of comparison impossible.

11.4.2 Incrementality

Evidence shows that by the early 1960's bulk bins were used by 80 percent of the apple industry. Furthermore, studies had been done which showed bulk bins to be much more cost-effective than bushel boxes. This seems to imply that many, if not most, apple producers would have purchased bulk bins without the incentive. It is assumed, in the case of bulk bins, that 20 per-

Table 11-3

ECONOMIC APPRAISAL OF BULK BINS VS. BUSHEL APPLE BOXES:
SAVINGS OF BULK BINS OVER BUSHL BOXES:1 ACRE=300 BUSHELS.
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)	BENEFITS($000)			TOTALS($000)		
	INVESTMENT						
	CONTAINERS	FRESH	PROCESS	SUBSIDY	COST	BENEFIT	NETFLOW
1	-.20	.18	-.08	0.00	-.20	.10	.30
2	0.00	.18	-.08	0.00	0.00	.10	.10
3	0.00	.18	-.08	0.00	0.00	.10	.10
4	0.00	.18	-.08	0.00	0.00	.10	.10
5	0.00	.18	-.08	0.00	0.00	.10	.10
6	0.00	.18	-.08	0.00	0.00	.10	.10
7	0.00	.18	-.08	0.00	0.00	.10	.10
8	0.00	.18	-.08	0.00	0.00	.10	.10
9	0.00	.18	-.08	0.00	0.00	.10	.10
10	-.26	.18	-.08	0.00	-.26	.10	.35
11	0.00	.18	-.08	0.00	0.00	.10	.10
12	0.00	.18	-.08	0.00	0.00	.10	.10
13	0.00	.18	-.08	0.00	0.00	.10	.10
14	0.00	.18	-.08	0.00	0.00	.10	.10
15	0.00	.18	-.08	0.00	0.00	.10	.10
16	0.00	.18	-.08	0.00	0.00	.10	.10
17	0.00	.18	-.08	0.00	0.00	.10	.10
18	0.00	.18	-.08	0.00	0.00	.10	.10
19	0.00	.18	-.08	0.00	0.00	.10	.10
20	-.31	.18	-.08	0.00	-.31	.10	.40

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1.14

cent of participants required the incentive to purchase the bins. This assumption is reasonable given the overwhelming advantages of bulk bins over bushel boxes. By utilizing the 20 percent figure a NPV of $894,900 is generated.

11.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the private producer who is faced with the decision of utilizing bulk bins or bushel boxes. The results using this approach are set out in Table 11-4.

The base case project would generate a NPV of savings of $1,450.

11.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) all provincial and federal sales taxes have been removed;

b) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

c) the capital grant of $10 per bulk bin has been removed from the revenue side.

The effect of these adjustments was to lower the net present value of the project from $1,450 to $1,140.

11.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Table 11-5. As indicated, the base case net present value is most sensitive to changes in the discount rate, and to changes in sales of fresh apples.

Table 11-4

FINANCIAL APPRAISAL OF BULK BINS VS. BUSHEL APPLE BOXES:
SAVINGS OF BULK BINS OVER BUSHL BOXES:1 ACRE=300 BUSHELS.
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)	BENEFITS($000)			TOTALS($000)		
	INVESTMENT						
	CONTAINERS	FRESH	PROCESS	SUBSIDY	COST	BENEFIT	NETFLOW
1	-.35	.18	-.08	.15	-.35	.25	.59
2	0.00	.18	-.08	0.00	0.00	.10	.10
3	0.00	.18	-.08	0.00	0.00	.10	.10
4	0.00	.18	-.08	0.00	0.00	.10	.10
5	0.00	.18	-.08	0.00	0.00	.10	.10
6	0.00	.18	-.08	0.00	0.00	.10	.10
7	0.00	.18	-.08	0.00	0.00	.10	.10
8	0.00	.18	-.08	0.00	0.00	.10	.10
9	0.00	.18	-.08	0.00	0.00	.10	.10
10	-.35	.18	-.08	0.00	-.35	.10	.44
11	0.00	.18	-.08	0.00	0.00	.10	.10
12	0.00	.18	-.08	0.00	0.00	.10	.10
13	0.00	.18	-.08	0.00	0.00	.10	.10
14	0.00	.18	-.08	0.00	0.00	.10	.10
15	0.00	.18	-.08	0.00	0.00	.10	.10
16	0.00	.18	-.08	0.00	0.00	.10	.10
17	0.00	.18	-.08	0.00	0.00	.10	.10
18	0.00	.18	-.08	0.00	0.00	.10	.10
19	0.00	.18	-.08	0.00	0.00	.10	.10
20	-.35	.18	-.08	0.00	-.35	.10	.44

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1.45

Table 11-5

Sensitivity Analysis
Bulk Bin Construction Programme
(NPV in '000 $1978)

Savings of bulk bins over bushel boxes (300 bushels of apples)

Variable		Cost Benefit Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			1.65	1.14	.86		
	BCR			2.552	2.470	2.309		
Container Cost	NPV	1.09	1.11	1.12	1.14	1.16	1.17	1.19
	BCR	2.906	2.745	2.600	2.470	2.353	2.246	2.148
Fresh Sales	NPV	.91	.99	1.06	1.14	1.22	1.29	1.37
	BCR	1.771	2.004	2.237	2.470	2.704	2.937	3.170

Variable		Financial Analysis -15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			2.00	1.45	1.13		
	BCR			1.986	1.905	1.790		
Container Cost	NPV	1.37	1.40	1.42	1.45	1.47	1.50	1.52
	BCR	2.241	2.117	2.005	1.905	1.814	1.732	1.656
Fresh Sales	NPV	1.22	1.29	1.37	1.45	1.52	1.60	1.68
	BCR	1.443	1.597	1.751	1.905	2.059	2.213	3.367

12.0 Refrigerated Containers

12.1 Sector Profile

Nova Scotia has long been an exporter of fresh fruit to foreign markets. The bulk of the fresh fruit export being comprised of McIntosh apples and lowbush blueberries. Apples have been exported from Nova Scotia for many years. The first apples sent to England are said to have been shipped by sailing vessels from Halifax to Liverpool in 1849. In 1861 the first cargo of apples was shipped direct from Annapolis Royal to London, England. To keep the apples fresh in transit frozen lumber or lumber coated with ice was used to reduce the temperature in the ships.*

Historically, the market for Nova Scotia's apples has been the United Kingdom, Scotland in particular, and the West Indies. By referring back to Table 10-2 it can be seen that the export share of the province's apple crop has declined from 20.2 percent in 1961 to a current level of around 5 percent. One reason suggested for the decline is the nature of the export product. The McIntosh, which is the predominant export variety, is felt to be too soft by the populous southern portion of the United Kingdom. A harder variety such as Delicious or Gravenstein would be preferred.

As mentioned, lowbush blueberries are also offered for export by Nova Scotian producers. Up until 1972, approximately 70 percent of the total Nova Scotia production was usually sold to manufacturers in Maine, while the other 30 percent was sold to Canadian manufacturers. Since 1972, there have been increasing amounts of Nova Scotia berries sold in European countries such as West

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* The historical information is from a paper presented by Don MacDougall, Transportation Specialist with the Department of Development. The contents appeared in the <u>Situation Report of the Annapolis Valley Apple Industry</u>, August 3, 1978.

Germany, Sweden, Norway, and the Netherlands.* Table 12-1 indicates the disposition of the Nova Scotia blueberry crop prior to 1972 and after. The growth of the export segment of the lowbush blueberry crop is in no small part due to the acquisition of refrigerated containers by the Nova Scotia Fruit Growers Association (NSFGA), and the Blueberry Producers Association.

These refrigerated containers or "reefers" have served to stabilize local prices and allow Nova Scotian producers to compete in the world market. In the case of the apple industry the refrigerated containers have, in effect, given the local producers something to strive for. With the European market accessible because of the containers, our producers are gearing their production towards varieties which might gain wider acceptance and thus expand their overseas market share. The lowbush blueberry industry is heavily dependent on the "reefer" container in that the export market accounts for a significant proportion of total production. The availability of refrigerated containers has guaranteed a market for the local producers and they base their production pattern on this guarantee. The loss of the foreign market would undoubtedly be disastrous for the Nova Scotian blueberry industry.

12.2 Project Description

12.2.1 Objectives

The purpose of the Refrigerated Containers Incentive Programme is:

- to assist in developing international markets for Nova Scotia fruits and vegetables through the expanded availability of refrigerated containers. The specific objective is to place an additional 20 units in service in the agricultural industry.

As previously mentioned, opportunities for markets for Nova Scotia fruit, primarily apples and blueberries, have been expanding in European countries. In spite of the opportunity, difficulties in transporting frozen blueberries to

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* Taken from A Situation Report, 1980, Lowbush Blueberry Production and Marketing in Nova Scotia.

Table 12-1

Nova Scotia Lowbush Blueberry Production
and Disposition of the Crop
1961 - 1979

Year	Production lbs.	European Market lbs.	European Market %	Local and U.S. lbs.	Local and U.S. %
1979	10,723,011	6,433,807	60	4,289,204	40
1978	11,618,207	6,970,924	60	4,647,283	40
1977	8,202,370	2,050,592	25	6,151,778	75
1976	6,842,349	4,105,409	60	2,736,940	40
1975	9,928,632	4,964,316	50	4,964,316	50
1974	7,557,000	3,778,500	50	3,778,500	50
1973	10,075,000	5,037,500	50	5,037,500	50
1972	9,897,000	4,948,500	50	4,948,500	50
1971	7,100,000	-	0	7,100,000	100
1970	8,200,000	-	0	8,200,000	100
1969	8,882,000	-	0	8,882,000	100
1968	2,100,000	-	0	2,100,000	100
1967	11,700,000	-	0	11,700,000	100
1966	7,600,000	-	0	7,600,000	100
1965	7,000,000	-	0	7,000,000	100
1964	5,100,000	-	0	5,100,000	100
1963	7,000,000	-	0	7,000,000	100
1962	7,400,000	-	0	7,400,000	100
1961	5,700,000	-	0	5,700,000	100

Source: A Situation Report - 1980, Lowbush Blueberry Production and Marketing in Nova Scotia.

Europe were encountered because of a lack of refrigerated containers. With the market opportunity available the Blueberry Producers Association and the NSFGA approached the Management Committee in 1976 to assist in the acquisition costs of 20 refrigerated containers for the European market. The Management Committee agreed to pay 75 percent of the acquisition costs for the containers which were subsequently put into service during the summer of 1977.

As the European market continued to increase, it became apparent that additional containers would be necessary. The Blueberry and Fruit Growers again approached the Management Committee in 1978 for financial assistance. The Management Committee approved assistance of $250,000 for the purchase of 20 refrigerated containers which went into service during the summer and fall of 1979.

The original estimated cost of the Programme, as noted in Schedule "A", was $500,000 to be divided as follows:

Federal Share	Provincial Share	Producers' Share
$300,000	$75,000	$125,000

12.2.2 Project Performance

A summary of expenditures, amount of subsidy, and number of containers purchased is presented in Table 12-2. Originally, it was planned that only 20 containers were to be assisted. However, the producers' associations expressed a need for more containers and therefore another 20 were assisted. The level of assistance provided by government was 75 percent of acquisition costs for the first 20 and a reduced level of 45 percent for the subsequent 20 refrigerated containers.

The first containers purchased each cost $17,535.55 in 1976 dollars with an overall cost of $350,711 for 20 containers. The government assistance amounting to $263,033.25 accounted for approximately 70 percent of the estimated contribution that the public sector was estimating it would make.

Table 12-2

Expenditures,[1] Subsidies and
Number of Containers Purchased
1976 - 1979

Year	Expenditures $	Government Share $	Government Share %	Producer Share $	Producer Share %	No. of Containers
1976	350,711	263,033	75	87,678	25	20
1977	-	-	-	-	-	-
1978	550,000	250,000	45	300,000	55	20
1979	-	-	-	-	-	-
TOTAL	900,711	513,033		387,678		40

Source: Annual Reports

Note: 1. All expenditures in constant dollars.

The second group of containers purchased were acquired at a cost of $27,500 each in 1978 dollars, with an overall cost of $550,000 for 20 containers. The government granted assistance in the amount of $250,000 for the containers. In order to provide this assistance it was necessary for public funds to be transferred to the Refrigerated Containers Incentive Programme from some other programme in the Agreement.

With respect to the stated objectives of the Programme, they have been met two-fold. The increasing importance of the export market, particularly to blueberry producers, resulted in an increased demand for containers in order to meet market commitments. The presence of these 40 refrigerated containers plus a prior 20 purchased by the NSFGA have guaranteed the local producers a piece of the foreign market. Previous to the ownership of containers by the producer associations there was a dependence on the container companies to provide containers during the peak season. However, in many instances the container companies were unable to guarantee service to the local producers favouring the heavier flows from Toronto and Montreal. Hence, the perceived need for local ownership of enough containers to guarantee the crop getting to market.

The producer associations are not in reality using their own containers during the shipping season. Various leasing arrangements have been made with the container lines which provide rental income on a per diem basis and cover repair, maintenance, administration, insurance and fuel costs for the containers. The leasing arrangement also guarantees a certain number of shipping movements per year to the producers' associations. It is anticipated that approximately 125-40 foot refrigerated containers each for apples and blueberries will be shipped out of Halifax yearly. A 40 foot container has a capacity for 850 bushels of apples and 40,000 pounds of blueberries.

12.3 Methodology

12.3.1 Methodological Issues

In general, the method used in the Cost-Benefit Analysis of the Refrigerated Containers Incentive adheres to the approach outlined in Chapter Two. However, there were slight differences in this analysis which should be mentioned:

a) This analysis is a combination of two Cost-Benefit programmes:

   i) costs and benefits associated with the refrigerated containers themselves; and,

   ii) costs and benefits associated with incremental acreage of blueberry land which was attributed to the availability of refrigerated containers.

b) The net present values and gross benefit-cost ratios generated by the programme are a combination (by addition) of (i) and (ii).

The incremental capital and operating costs and revenues were estimated using historical data and by simulating the cost and revenue impact of the operation of the containers and the resultant expansion of blueberry acreage. A twenty year evaluation period was employed to examine these incremental effects.

12.3.2 Assumptions

The following assumptions were made in carrying out the Cost-Benefit Analysis:

a) Scope of Evaluation: all cost and benefit estimates were based on:

   i) 40 refrigerated containers which were brought into service over a two year period

   ii) 1940 acres of blueberry land which was brought into production over a four year period.

It was assumed that the purchase of 40 refrigerated containers stimulated the production of 1940 acres of blueberry land. This assumption was based on the notion that the refrigerated containers, in effect, opened up the European market, which enabled the production of this extra acreage. The

1940 acres figure was derived from the number of acres cleared under the Blueberry Land Clearing Incentive. In fact, this acreage could very well be an under estimation of the impact of refrigerated containers on local producers. Apple production was not included because the export market is a relatively small share of the apple crop, as opposed to 60 percent of the blueberry crop going for export sales.

b) Base Year: all cost and benefit projections are expressed in 1978 constant dollars.

c) Investment Costs:

i) Containers: the refrigerated containers were purchased in two installments of 20. These containers were purchased in year 1 and year 3 of the evaluation. The costs were as follows:

Year 1	20 containers	$401,213.40
Year 3	20 containers	$550,000.00

The cost of containers in year 1 was inflated to 1978 dollars. The refrigerated containers accounted for all investment costs.

d) Operating Costs: operating costs were associated with the production of 1940 additional acres of blueberries. This land was cleared under the Blueberry Land Clearing Incentive. The following assumptions were made upon which operating costs were based:

i) maximum yield per acre was 1,500 lbs/acre

ii) 100 percent output of 1,500 lbs/acre was not instantaneous. Full production was reached in year 6 by the following path:

Year 1	30%
Year 2	50%
Year 3	70%
Year 4	80%
Year 5	90%
Year 6	100%

Associated costs and revenues were adjusted accordingly.

iii) acreage was brought into production in the following manner:

Year 1	199 acres
Year 2	329 acres
Year 3	199 + 547 acres
Year 4	329 + 865 acres
Year 5	199 + 547 acres
Year 6	329 + 865 acres
"	
"	
"	
Year 20	

- acres produce crop only every second year
- crop is burned in off-years to allow vegetative growth.
- the Annual Reports provided the acreage figures

Labour costs: labour costs were assumed to be 87.5 percent of harvest and handling costs. This accounted for 11.4¢/lb out of a total of 13¢/lb for harvest and hauling. The cost of labour was derived from the Situation Report 1980, Lowbush Blueberry Production and Marketing in Nova Scotia.

Production costs: production costs were comprised of:

i) land clearing - assumed to be \$225/acre, takes place in years 1-4.

ii) fixed production costs - assumed to be \$88.20/acre, includes the following activities:

burning
insect control
weed control
pollination
fertilization

- the cost of labour was included in these costs.

Harvesting and handling costs: these costs were dependent on the number of pounds of blueberries harvested. A cost of 13¢/lb was assumed. Labour accounted for most of this cost (87.5%). The remaining 12.5 percent was assumed to be a contribution to machinery and other equipment employed.

Processing costs: processing costs were actually an amalgamation of buyer's charges and processing costs.

*buyer's charges	1.5¢/lb
°processing costs	31¢/lb

* buyer's charges were actually 3¢/lb in 1978, however, only 50 percent of crop moved through buyers.

° processing costs comprised of a 32 percent transport component and a 68 percent processing fee.

e) Benefits:

i) Lease: leasing arrangements were made with container companies by the fruit producers associations. The container companies rented the 40 containers on a per diem basis over a 365 day year. Lease revenue was received on a yearly basis in the year after the initial container purchases. This was stipulated because the containers were not put into service until the year following their purchase. Confidentiality prohibited the use of precise rental rates in determining lease revenue.

ii) Refrigerated container subsidy: this subsidy was applied at the rate of 75 percent of the cost of the first 20 containers and at a reduced rate of 45 percent of the cost of the subsequent 20. The subsidy was paid in years 1 and 3.

iii) Salvage value: a salvage value of 25 percent was applied to replaced containers. Refrigerated containers were replaced in years 9, 11, 17 and 19.

iv) Sales: sales were derived from the sale of the blueberry crop. An fob Halifax price (1978 dollars) of 77.1¢/lb was assumed. The sales revenue varied from year to year depending on the amount harvested.

v) Subsidy: a second subsidy existed which applied to the clearing of blueberry land. This incentive, part of the Land Development Programme, paid $75 per acre cleared. The subsidy was paid in years 1-4.

12.4 Results

12.4.1 Cost-Benefit Analysis

The costs and benefits of the base case 40 refrigerated containers and associated blueberry acreage are set out in cash flow form in Table 12-3. The analysis indicates that the project will yield the following results:

Net Present Value	$1,728,930
Benefit-Cost Ratio	1.319

The base case results incorporate the total programme. Therefore, the programme as a whole would yield the previously noted results.

From the point of view of society as a whole, the programme to date has been worthwhile. Note that NPV's and BCR's cannot be compared across projects.

12.4.2 Incrementality

Participants in the Refrigerated Container Incentive Programme were not included in the Survey carried out by the Department of Agriculture and Marketing early in 1979. Consequently, we have no information on the degree to which the incentives offered under the programme were responsible for the investment in containers. In our judgement, however, we feel that the degree of incrementality is low. This conclusion is based on the information contained in Table 12-3, which indicates that the investment in the 40 containers included under the programme will be recovered from revenues flowing from the lease arrangements alone. The subsidy, while perhaps important from the perspective of the timing of the investment, does not appear to have been a critical factor in determining whether the investment could have been made.

<u>Table 12-3</u>

ECONOMIC APPRAISAL OF REFRIGERATED CONTAINERS AND SSOCIATED
BLUEBERRY ACREAGE
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)						BENEFITS($000)				TOTALS($000)		
	INVESTMENT	OPERATING COSTS											
YEAR	CONTAINERS	LABOR	PRODUCTION	HARVEST	PROCESS	LEASE	SUBSIDY	SALVAGE	SALES	SUBSIDY	COST	BENEFIT	NETFLOW
1	401.21	6.11	62.33	1.46	29.10	0.00	0.00	0.00	69.04	0.00	500.21	69.04	-431.17
2	0.00	10.10	103.04	2.41	48.02	85.92	0.00	0.00	114.15	0.00	163.57	200.07	36.50
3	550.00	26.99	188.87	6.43	128.51	85.92	0.00	0.00	304.85	0.00	900.79	390.77	-510.01
4	0.00	43.41	299.94	10.34	206.70	197.61	0.00	0.00	490.36	0.00	560.38	687.97	127.59
5	0.00	42.26	65.80	10.06	201.24	197.61	0.00	0.00	477.40	0.00	319.36	675.01	355.65
6	0.00	67.85	105.31	16.16	323.12	197.61	0.00	0.00	766.53	0.00	512.44	964.14	451.70
7	0.00	57.53	65.80	13.70	273.98	197.61	0.00	0.00	649.95	0.00	411.01	847.56	436.56
8	0.00	92.30	105.31	21.98	439.53	197.61	0.00	0.00	1042.70	0.00	659.12	1240.31	581.19
9	401.21	82.57	65.80	16.85	337.01	197.61	0.00	100.30	799.49	0.00	903.44	1097.40	193.97
10	0.00	141.73	105.31	26.95	539.91	197.61	0.00	0.00	1280.82	0.00	813.89	1478.43	664.55
11	550.00	101.83	65.80	18.18	363.68	197.61	0.00	137.50	862.75	0.00	1099.49	1197.86	98.38
12	0.00	173.17	105.31	29.10	582.08	197.61	0.00	0.00	1343.25	0.00	889.66	1540.86	651.20
13	0.00	114.56	65.98	18.18	363.68	197.61	0.00	0.00	862.75	0.00	562.39	1060.36	497.97
14	0.00	183.35	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	899.84	1540.87	641.02
15	0.00	114.56	65.98	18.18	363.68	197.61	0.00	0.00	862.75	0.00	562.39	1060.36	497.97
16	0.00	183.35	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	899.84	1540.87	641.02
17	401.21	114.56	65.80	18.18	363.68	197.61	0.00	100.30	862.75	0.00	963.43	1160.66	197.24
18	0.00	183.35	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	899.84	1540.87	641.02
19	550.00	114.56	65.80	18.18	363.68	197.61	0.00	137.50	862.75	0.00	1112.21	1197.86	85.65
20	0.00	183.35	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	899.84	1540.87	641.02

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1728.93

12.4.3 Financial Analysis

The financial analysis has been undertaken from the perspective of the private sector. The results using this approach are set out in Table 12-4. The base case project would generate a NPV of $2,085,730.

12.4.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments made to the financial variables in order to present the information in an economic context are as follows:

a) labour costs have been reduced to reflect the impact of unemployment on opportunity cost;

b) the subsidy on refrigerated containers has been removed from the revenue side;

c) the subsidy of $75 per acre of blueberry land cleared has been removed from the revenue side.

The effect of these adjustments is to lower the net present value of the project from $2,085,730 to $1,728,930.

12.4.5 Sensitivity Analysis

The results of the sensitivity analysis are set out in Table 12-5. As indicated, the base case net present value is extremely sensitive to changes in the discount rate, to changes in container cost, to changes in processing costs and to changes in lease revenue. Somewhat less sensitivity is exhibited when labour and production costs are changed. Changes in harvest costs have little effect on the base case net present value.

Table 12-4

FINANCIAL APPRAISAL OF REFRIGERATED CONTAINERS AND SSOCIATED BLUEBERRY ACREAGE
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)					BENEFITS($000)					TOTALS($000)		
	INVESTMENT	OPERATING COSTS											
YEAR	CONTAINERS	LABOR	PRODUCTION	HARVEST	PROCESS	LEASE	SUBSIDY	SALVAGE	SALES	SUBSIDY	COST	BENEFIT	NETFLOW
1	401.21	10.19	62.33	1.46	29.10	0.00	300.91	0.00	69.04	14.93	504.29	384.88	-119.41
2	0.00	16.84	103.04	2.41	48.02	85.92	0.00	0.00	114.15	24.68	170.31	224.74	54.44
3	550.00	44.98	188.87	6.43	128.51	85.92	250.00	0.00	304.85	41.03	918.78	681.80	-236.98
4	0.00	72.35	299.94	10.34	206.70	197.61	0.00	0.00	490.36	64.88	589.32	752.84	163.53
5	0.00	70.43	65.80	10.06	201.24	197.61	0.00	0.00	477.40	0.00	347.53	675.01	327.48
6	0.00	113.09	105.31	16.16	323.12	197.61	0.00	0.00	766.53	0.00	557.67	964.14	406.47
7	0.00	95.89	65.80	13.70	273.98	197.61	0.00	0.00	649.95	0.00	449.36	847.56	398.20
8	0.00	153.84	105.31	21.98	439.53	197.61	0.00	0.00	1042.70	0.00	720.65	1240.31	519.66
9	401.21	117.95	65.80	16.85	337.01	197.61	0.00	100.30	799.49	0.00	938.82	1097.40	158.58
10	0.00	188.97	105.31	26.95	539.91	197.61	0.00	0.00	1280.82	0.00	861.13	1478.43	617.31
11	550.00	127.29	65.80	18.18	363.68	197.61	0.00	137.50	862.75	0.00	1124.94	1197.86	72.92
12	0.00	203.73	105.31	29.10	582.08	197.61	0.00	0.00	1343.25	0.00	920.22	1540.86	620.65
13	0.00	127.29	65.98	18.18	363.68	197.61	0.00	0.00	862.75	0.00	575.12	1060.36	485.24
14	0.00	203.73	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	920.22	1540.87	620.65
15	0.00	127.29	65.98	18.18	363.68	197.61	0.00	0.00	862.75	0.00	575.12	1060.36	485.24
16	0.00	203.73	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	920.22	1540.87	620.65
17	401.21	127.29	65.80	18.18	363.68	197.61	0.00	100.30	862.75	0.00	976.16	1160.66	184.51
18	0.00	203.73	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	920.22	1540.87	620.65
19	550.00	127.29	65.80	18.18	363.68	197.61	0.00	137.50	862.75	0.00	1124.94	1197.86	72.92
20	0.00	203.73	105.31	29.10	582.08	197.61	0.00	0.00	1343.26	0.00	920.22	1540.87	620.65

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 2085.73

Table 12-5

Sensitivity Analysis

Refrigerated Containers Incentive

Refrigerated Containers and Associated Blueberry Acreage

(NPV in '000 $1978)

Variable		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
		Benefit-Cost Analysis						
Discount Rate	NPV			3308.3	1728.93	895.30		
	BCR			1.39	1.32	1.24		
Container Cost	NPV	1925.46	1859.95	1794.44	1728.93	1663.42	1597.91	1532.4
	BCR	1.37	1.35	1.34	1.32	1.30	1.29	1.27
Labour Cost	NPV	1823.71	1792.12	1760.52	1728.93	1697.33	1665.74	1634.14
	BCR	1.34	1.34	1.33	1.32	1.31	1.30	1.30
Production Cost	NPV	1870.05	1823.01	1775.97	1728.93	1681.89	1634.85	1587.81
	BCR	1.35	1.34	1.33	1.32	1.31	1.30	1.29
Harvest Cost	NPV	1747.05	1741.01	1734.97	1728.93	1722.89	1716.85	1710.81
	BCR	1.32	1.32	1.32	1.32	1.32	1.32	1.32
Processing Cost	NPV	2091.31	1970.51	1849.72	1728.93	1608.14	1487.34	1366.55
	BCR	1.4.	1.38	1.35	1.32	1.29	1.26	1.24
Lease Revenue	NPV	1529.95	1596.28	1662.6	1728.93	1795.26	1861.58	1927.91
	BCR	1.28	1.29	1.31	1.32	1.33	1.34	1.37

Variable		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
		Financial Analysis						
Discount Rate	NPV			3619.23	2085.73	1265.35		
	BCR			1.42	1.37	1.32		
Container Cost	NPV	2282.26	2216.75	2151.24	2085.73	2020.22	1954.71	1889.20
	BCR	1.42	1.40	1.39	1.37	1.35	1.34	1.32
Labour Cost	NPV	1121.57	2170.29	2128.01	2085.73	2043.45	2001.17	1958.90
	BCR	1.40	1.39	1.38	1.37	1.36	1.35	1.34
Production Cost	NPV	2226.86	2179.81	2132.77	2085.73	2038.69	1991.65	1944.61
	BCR	1.41	1.39	1.38	1.37	1.36	1.35	1.34
Harvest Cost	NPV	2103.85	2097.81	2091.77	2085.73	2079.69	2073.65	2067.62
	BCR	1.38	1.37	1.37	1.37	1.37	1.37	1.37
Processing Cost	NPV	2448.11	2327.32	2206.52	2085.73	1964.94	1844.15	1723.35
	BCR	1.46	1.43	1.40	1.37	1.34	1.31	1.29
Lease Revenue	NPV	1886.76	1953.08	2019.41	2085.73	2152.06	2218.38	2284.71
	BCR	1.34	1.35	1.36	1.37	1.38	1.39	1.40

13.0 Greenhouse Incentive

13.1 Sector Profile

According to Statistics Canada data for 1979, the Nova Scotia greenhouse industry consists of 94 operators with slightly more than 1.8 million square feet under glass and plastic. Based on sales, the industry is comprised mainly of two types of operators, although the dividing line between the two is not sharply defined. The smaller of the two classes contains the large, full-time operators for whom greenhouse operations represents a full-time primary activity. These operators employ substantial numbers of full-time hired labour in their operation. The other class of operator consists of the middle to small operators for whom the business is primarily a family run operation and who rely to a much greater extent on part-time labour. Unlike their larger brethern, many of the smaller operations operate for only part of the year, mainly to serve the spring market for vegetable and bedding plants.

Nova Scotia greenhouse operators concentrate their production in the three crops areas: flowers, bedding plants and vegetables. The cropping pattern appears to vary systematically according to operator size as shown in the following table.

Table 13-1

Proportion of Sales Derived from Different Crops By Operator Size, 1976-1979 Average

Size	Flowers and Bedding Plants	Vegetables
Large	93%	7%
Middle	72%	28%
Small	67%	33%

Source: Derived From Statistics Canada, special compilation.

Geographically, the greenhouse industry is concentrated in four counties - Digby, Halifax, Hants and Kings - with the notable exception of one very large operator in Cumberland county. Lesser concentrations of activity occur in Annapolis, Antigonish, Cape Breton and Colchester counties.

13.2 Project Description

The potential to develop greater self-sufficiency in the production of agricultural commodities in Nova Scotia is identified as one of the prime opportunities to be exploited under the Agriculture Subsidiary Agreement. For the greenhouse industry this general objective was translated into the specific objective of increasing greenhouse capacity by 350,000 square feet over the five year term of the Agreement. This additional capacity was intended to increase self-sufficiency in tomato production to 47 percent from 40 percent of consumption. Cucumber production was expected to increase from 50 percent to 60 percent of consumption over the same five year period.

It was felt that the major constraint on achieving these objectives was the high capital cost of building and equipment necessary for greenhouse expansion. Thus, the project was designed to provide assistance in the form of a 25 percent grant towards the capital costs of constructing or modernizing greenhouses. The planned government contribution was $800,000 which, combined with the producer contribution of $2.4 million, would result in total greenhouse project expenditure of $3.2 million over the five year period.

Initially the maximum amount of assistance was set at $20,000 per greenhouse grower. This limit was raised during the project to a new maximum of $70,000 per greenhouse grower. Established commercial greenhouse growers and new entrants who could establish their ability to operate a greenhouse production unit were eligible to receive grants.

13.3 Project Performance

Project performance is summarized in this section for the period 1976 through 1979, inclusive. Several alternative measures of performance are available: actual expenditure relative to planned project expenditure; actual increase in greenhouse capacity relative to planned increase in greenhouse capacity; creation of additional employment and incomes through project implementation; and determining whether the investment undertaken in the project are good ones from both a private sector and a public sector point of view. The latter two measures are discussed in the next section.

For the five year period of the project, planned project expenditure by government was $800,000. Over the four year time span covered in this report, actual expenditure amounts to $388,675 or 49 percent of planned. If implementation continues to occur at the same pace, it can be expected that the project will finish by spending approximately 60 percent of its target.

The number of grants made, their geographical distribution and the allocation of expenditure according to the cropping pattern in funded facilities are summarized in the following two tables.

Based on the number of facilities funded, 62 percent of the grants were allocated to four counties - Digby, Halifax, Hants and Kings. Annapolis, Antigonish and Cumberland received a further 22 percent of the grants made. Alternatively, on an expenditure basis, the four largest county recipients - Cumberland, Halifax, Hants and Kings - received 81 percent of the grants by value. As a measure of where greenhouse production is concentrated the latter gives a better indication than the former. That the three counties - Halifax, Hants and Kings - exhibit the heaviest concentration of activity is not surprising given their relative proximity to the major urban market of the Halifax Metropolitan Area.

Table 13-2

Number of Facilities and Grants by County
1976 - 1979

County	Number of Facilities	Grants	Proportion[1]
Annapolis	5	$ 19,482	5%
Antigonish	9	11,671	3
Cape Breton	6	7,628	2
Colchester	4	4,295	1
Cumberland	9	38,317	10
Digby	11	20,931	5
Halifax	11	74,996	19
Hants	16	138,036	36
Inverness	2	6,536	2
Kings	26	60,295	16
Lunenburg	1	178	*
Queens	3	5,916	2
Yarmouth	1	394	*
TOTAL	104	$388,675	

Source: Annual Reports, 1976-1979, Canada/Nova Scotia Subsidiary Agreement, Agriculture Development.

Notes: 1. Does not add to 100 because of rounding.

* Less than 1 percent.

Table 13-3

Grants Paid by Producer Cropping Pattern
1976 - 1979

Crops	Grant	Proportion
Flowers	$ 91,595	24%
Vegetables	112,802	32
Bedding Plants	163,760	38
Tobacco	13,681	4
Tree Seedings	6,837	2
TOTAL	$388,675	100%

Source: Annual Reports, 1976-1979, Canada/Nova Scotia Subsidiary Agreement, Agriculture Development.

From Table 13-3 the concentration of project expenditure in three crop areas is evident. Flowers, vegetables and bedding plants account for 94 percent of the value of grants paid out. On the one hand, this concentration is not surprising given the strong emphasis on flowers and bedding plants shown in the distribution of sales from greenhouses in Table 13-1. On the other hand, it is noteworthy that vegetables account for 32 percent of grants by value in light of the pattern of sales data mentionned. This may be a result of the project administration directing its efforts towards vegetables. However, given that increased vegetable production, particularly tomatoes and cucumbers, is one of the stated objectives for this project, one might turn around and ask why vegetables only manage to take up one-third of project expenditure in the period examined. Either way one is led to wonder whether achievement of the stated level of self-sufficiency in the production of tomatoes and cucumbers will be met by the end of the Agreement.

Turning to the actual output of the project, activity is split between installation of new facilities and modernization of existing facilities. Data on the division of project activity are neither good nor easily accessible. The division has been estimated as follows: New construction costs range from as low as $4.50 per square foot to as high as $7.50 per square foot. Allowing for increasing costs over the period, an average value of $6.00 per square foot together with the estimated 170,100 square feet of additional capacity installed in the four year period lead to an estimated total expenditure on new construction of $1,020,600. The government share of this amount is 25 percent or $255,150. This leaves $133,525 of government expenditure for modernization, implying total modernization spending of $534,100 over the four years. These estimates do not agree with what is stated in the Annual Reports; they are however, supported by data supplied by staff working closely with the greenhouse project.

The 170,100 square feet of additional greenhouse capacity represents 49 percent of the stated expansion target of 350,000 square feet. Assuming that all of the probable project expenditure in the last year of the Agreement is allocated to the installation of new facilities, approximately 17,000 square feet could be added to capacity. This would bring the project assisted installed capacity to 187,100 square feet, or 53 percent of its original target. These figures must be viewed in the context of what has happened to total greenhouse capacity in Nova Scotia.

Table 13-4

Greenhouse Capacity in Nova Scotia
1968 - 1979
('000 Square Feet)

Year	Capacity
1968	1,264
1969	1,308
1970	1,770
1971	1,806
1972	1,883
1973	2,192
1974	2,216
1975	2,055
1976	2,130
1977	2,048
1978	1,819
1979	1,841*

Source: Nova Scotia Department of Agriculture and Marketing, Agriculture Statistics, 1978, p. 71.

Note: * Preliminary Figure

Greenhouse capacity in Nova Scotia over the period 1968-1979 is shown in Table 13-4. Two features of this table stand out. First, peak capacity was reached in the year 1973. Since then, installed capacity has declined, a phenomenon no doubt linked with the sharp increases in the price of fuel oil. Second, for the period 1976-1979, in spite of the fact that 171,000 square feet of new facilities have been built in Nova Scotia under the Agreement, total capacity has declined by 289,000 square feet. It would appear, therefore, that the incentives offered under the Agreement have been bucking a market inspired trend to lower capacity. Further, it seems fair to conclude that the decline in capacity would have been much greater without the Greenhouse Project.

Although it is obvious that the project has not and will not achieve its declared objectives, some positive results have been achieved. The newly installed facilities, by virtue of their higher energy efficiency, place the industry on a more solid footing to withstand future increase in energy costs. Much of the modernization expenditure has also been aimed at improving energy efficiency through, for example, installation of better heating systems and equipping greenhouses with thermal blankets to reduce heat loss at night. These measures also place the industry on a more secure base from which to deal with future energy price movements.

As for the future, under the current incentive scheme - offering a 25 percent grant toward capital costs for an approved project - greenhouse growers are not likely to see it as a preferred source of funding for energy related improvements in their operations. Alternative sources of funding are now available such as the Retrofitting Project under the Canada-Nova Scotia Subsidiary Agreement, Energy Conservation, where the grant provided can amount to as much as 40 percent of capital costs.

13.4 Methodology

13.4.1 Methodological Issues

For the most part the methodological issues connected with this project are related to the dearth of good quality, accurate information on the greenhouse industry in Nova Scotia. In order to conduct the analysis in a manner similar to which other projects have been treated, it is necessary to define a typical or average greenhouse operation, determine its revenue and cost characteristics and then apply these to a typical expansion undertaken through the Greenhouse Incentive Project. Several problems arise in this connection.

First, serious doubt surrounds whatever meaning can be attached to the term "average" greenhouse grower in Nova Scotia. As mentioned previously, there appear to be two or three distinct types of operators in the province: large, full-time operators who employ significant numbers of full-time hired labour; middle size operators some of whom operate full-time, some of whom are part-time, all of whom employ small numbers of full-time hired labour, most of whom rely more on part-time labour; and the small scale operators who appear to be mainly family run operations, seasonal in nature, employing only a small number of part-time help in addition to family members. Cropping patterns also vary significantly according to grower size (see Table 13-1). Differences in crops grown imply different heating costs. Size of operation and proportion of the year actually operating imply quite different labour cost characteristics.

Second, the manner in which labour costs are reported leaves much to be desired. The definitions of full-time labour and part-time labour are not clear, and almost certainly no universal notion exists across growers. For family run operations, frequently no labour costs are reported, since the operator simply takes his net return as payment for labour, managerial and entrepreneurial tasks. For analysis purposes it is necessary to impute a labour cost of operation but the lack of solid information on which to base such an estimate makes this any area of uncertainty.

Third, not all of the project expenditure was directed towards expanding greenhouse capacity in Nova Scotia. Modernization of existing greenhouses to increase their productivity or reduce their heating costs was also supported. Because of the mixed nature of these activities, uncertainty regarding costs and insufficient information concerning the benefits, detailed analysis of modernization sub-projects was not undertaken.

13.4.2 Assumptions

For this analysis, a stand alone expansion of 1,825 square feet was assumed. This size appears to be close to the average size of operation actually financed. Based on Statistics Canada data on the greenhouse industry and other data collected through interviews with knowledgeable people in the field, values were assumed for sales per square foot, labour costs per square foot, fuel costs per square foot, seed and seedling costs (purchases) per square foot, miscellaneous operating costs per square foot and investment costs per square foot.

a) Investment Costs per Square Foot: depending on the type of construction, the heating system to be installed and other factors, investment costs can run as high as \$7.50, but most operators appear to fall within the range of \$4.50 to \$6.00. A base case value of \$5.50 per square foot was assumed.

   In general, operating costs per square foot will depend on the proportion of the year that the greenhouse is operated and the types of crops grown. A grower who raises bedding plants for the spring, tomatoes over the winter and poinsettas in the fall would incur higher costs per square foot on an annual basis (and also generate higher revenue) than would an operator who serves only the spring peak demand for vegetables and/or bedding plants. The operating costs and revenues assumed here as base case values are meant to reflect full-time operation.

b) Labour Costs per Square Foot: the difficulties in determining labour costs have been described; on the basis of the information available from Statistics Canada and discussions with Nova Scotia Department of Agriculture and Marketing Staff, a base labour cost of \$1.35 per square foot was assumed.

c) Fuel Cost per Square Foot: fuel costs are also sensitive to the proportion of the year that the greenhouse is operated and the crops grown. Using the latest information available, a base case value of $1.05 per square foot was assumed. To reflect the likely situation for petroleum products in the coming years, this cost was increased at an annual rate of 2 percent in real terms over the 20 year period.

d) Purchases: these costs vary with the type of crops grown and the length of the operating year. A base case value of $0.80 per square foot was assumed.

e) Miscellaneous Operating Costs: these costs include all of the operating costs such as telephone, electricity, accounting, maintenance, packaging and so on. A base case value of $0.40 per square foot was assumed.

f) Sales Revenue: a base case value for sales of $4.00 per square foot was assumed. This is slightly less than recent values that have been attained by some growers. However, the range of values covered in the sensitivity analysis includes the likely range of sales levels.

g) It is assumed that the expansion constructed in this analysis is completed in a relatively short period of time in the off-season. Hence, the grower is able to realize a full year of sales and costs in the first year. To the extent that this is optimistic, the sales and cost figures reported for year one are overstated.

h) No opportunity cost has been assigned to land on which the expansion is located. In effect, this amounts to assuming that land was already owned and had no alternative use, or that the quantity of land is so small that ignoring any opportunity cost does no harm.

i) The maximum value of assistance per grower started at $20,000 and was later increased to $70,000. According to our information, no requests were made in which the government's share would fall below the maximum 25 percent. Hence the value of the grant used in the analysis is 25 percent of investment costs.

13.5 Results

13.5.1 Cost-Benefit Analysis

The costs and benefits of the base case 1,825 square foot greenhouse expansion are set out in cash flow form in Table 13-5. The analysis indicates that assumed expansion will yield the following results:

Net Present Value	$1,260
Benefit-Cost Ratio	1.02

Over the four years of the project considered in this analysis, a total of 170,100 square feet of additional greenhouse capacity have been added to the industry. Assuming the results obtained here are a representative average, the total net contribution to society from this project would be approximately $117,000 in present value terms. Since modernization benefits have not been included in the analysis, the contribution of the project may have been understated to some extent.

13.5.2 Incrementality

As with all the other projects, the issue of incrementality must be addressed for greenhouses. Here, however, the issue is less clearcut. No information was obtained in the Survey concerning how many growers undertook expansion only because of the existence of the incentives offered. It was noted previously that in Nova Scotia total greenhouse capacity has declined by 289,000 square feet over the period of the Agreement in spite of the 170,100 square feet added through the greenhouse project. Trends in capacity from other nearby provinces are mixed. New Brunswick data indicate a decline of 128,000 square feet over the 1975-1978 period. Newfoundland and Prince Edward Island experienced a modest increase of 18,000 square feet over the same period. It is difficult to make an unequivocal conclusion concerning incrementality under these circumstances. Per-

Table 13-5

ECONOMIC APPRAISAL OF AN 1825 SQ. FT. GREENHOUSE EXPANSION
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)					BENEFITS($000)		TOTALS($000)		
	INVESTMENT	OPE. COSTS								
YEAR	STRUCTURE	LABOR	PURCHASES	FUEL	OTHER	SALES	INCEN TIVE	COST	BENEFIT	NETFLOW
1	10.04	1.48	1.46	1.92	.73	7.30	0.00	15.62	7.30	-8.32
2	0.00	1.48	1.46	1.95	.73	7.30	0.00	5.62	7.30	1.68
3	0.00	1.48	1.46	1.99	.73	7.30	0.00	5.66	7.30	1.64
4	0.00	1.48	1.46	2.03	.73	7.30	0.00	5.70	7.30	1.60
5	0.00	1.48	1.46	2.07	.73	7.30	0.00	5.74	7.30	1.56
6	0.00	1.48	1.46	2.12	.73	7.30	0.00	5.78	7.30	1.52
7	0.00	1.48	1.46	2.16	.73	7.30	0.00	5.83	7.30	1.47
8	0.00	1.48	1.46	2.20	.73	7.30	0.00	5.87	7.30	1.43
9	0.00	1.72	1.46	2.25	.73	7.30	0.00	6.16	7.30	1.14
10	0.00	1.85	1.46	2.29	.73	7.30	0.00	6.33	7.30	.97
11	0.00	1.97	1.46	2.34	.73	7.30	0.00	6.50	7.30	.80
12	0.00	2.09	1.46	2.38	.73	7.30	0.00	6.67	7.30	.63
13	0.00	2.22	1.46	2.43	.73	7.30	0.00	6.84	7.30	.46
14	0.00	2.22	1.46	2.47	.73	7.30	0.00	6.88	7.30	.42
15	0.00	2.22	1.46	2.53	.73	7.30	0.00	6.94	7.30	.36
16	0.00	2.22	1.46	2.57	.73	7.30	0.00	6.98	7.30	.32
17	0.00	2.22	1.46	2.63	.73	7.30	0.00	7.04	7.30	.26
18	0.00	2.22	1.46	2.68	.73	7.30	0.00	7.09	7.30	.21
19	0.00	2.22	1.46	2.74	.73	7.30	0.00	7.14	7.30	.16
20	0.00	2.22	1.46	2.79	.73	7.30	0.00	7.20	7.30	.10

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= 1.26

haps the only thing that can be said is that the project helped to sustain the industry at a higher level of activity than would have otherwise been the case given the apparent signals being generated by the market.

13.5.3 Financial Analysis

The financial analysis has been undertaken from the point of view of private sector operators in accordance with the procedures specified in Chapter Two. The results of this analysis are set out in Table 13-6. For the base case project the Net Present Value is ($2,970).

13.5.4 Cost-Benefit vs. Financial Analysis

The conceptual and methodological differences which underlie the analytical frameworks have been explained in detail in Chapter Two. The adjustments which have been made to the financial variables in order to derive the economic results are:

a) labour costs have been adjusted by the shadow wage factors to reflect the impact of unemployment on the opportunity cost of labour;

b) the subsidy for construction has been removed from the revenue side.

The net effect of these adjustments in the base case is to increase the Net Present Value from a negative $2,970 to a positive value of $1,260.

13.5.4 Sensitivity Analysis

The results of the sensitivity analysis are presented in Table 13-7. A review of this table indicates that net present value is sensitive to changes in the discount rate and very sensitive to changes in labour costs, fuel costs and sales revenue. Furthermore, for the costs and revenue parameters adopted in this analysis, the net present value is sensitive to the size of expansion assumed. A smaller expansion yields lower NPV, while a larger will increase NPV realized.

Table 13-6

FINANCIAL APPRAISAL OF AN 1825 SQ. FT. GREENHOUSE EXPANSION
(1978 CONSTANT PRICES)
(BASE CASE)

	COSTS($000)					BENEFITS($000)		TOTALS($000)		
	INVESTMENT	OPE. COSTS								
YEAR	STRUCTURE	LABOR	PURCHASES	FUEL	OTHER	SALES	INCENTIVE	COST	BENEFIT	NETFLOW
1	10.04	2.46	1.46	1.92	.73	7.30	2.51	16.61	9.81	-6.80
2	0.00	2.46	1.46	1.95	.73	7.30	0.00	6.61	7.30	.69
3	0.00	2.46	1.46	1.99	.73	7.30	0.00	6.65	7.30	.65
4	0.00	2.46	1.46	2.03	.73	7.30	0.00	6.69	7.30	.61
5	0.00	2.46	1.46	2.07	.73	7.30	0.00	6.73	7.30	.57
6	0.00	2.46	1.46	2.12	.73	7.30	0.00	6.77	7.30	.53
7	0.00	2.46	1.46	2.16	.73	7.30	0.00	6.81	7.30	.49
8	0.00	2.46	1.46	2.20	.73	7.30	0.00	6.86	7.30	.45
9	0.00	2.46	1.46	2.25	.73	7.30	0.00	6.90	7.30	.40
10	0.00	2.46	1.46	2.29	.73	7.30	0.00	6.94	7.30	.36
11	0.00	2.46	1.46	2.34	.73	7.30	0.00	6.99	7.30	.31
12	0.00	2.46	1.46	2.38	.73	7.30	0.00	7.04	7.30	.26
13	0.00	2.46	1.46	2.43	.73	7.30	0.00	7.08	7.30	.22
14	0.00	2.46	1.46	2.47	.73	7.30	0.00	7.13	7.30	.17
15	0.00	2.46	1.46	2.53	.73	7.30	0.00	7.18	7.30	.12
16	0.00	2.46	1.46	2.57	.73	7.30	0.00	7.23	7.30	.07
17	0.00	2.46	1.46	2.63	.73	7.30	0.00	7.28	7.30	.02
18	0.00	2.46	1.46	2.68	.73	7.30	0.00	7.34	7.30	-.04
19	0.00	2.46	1.46	2.74	.73	7.30	0.00	7.39	7.30	-.09
20	0.00	2.46	1.46	2.79	.73	7.30	0.00	7.45	7.30	-.15

NET PRESENT VALUE AT 10.00% DISCOUNT RATE= -2.97

Table 13-7

Sensitivity Analysis
Greenhouse Expansion
(NPV in '000 $1978)

Variable		Benefit-Cost Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			3.93	1.26	(0.40)		
	BCR			1.05	1.02	.99		
Structure	NPV	2.63	2.18	1.72	1.26	.81	.35	(.11)
	BCR	1.04	1.04	1.03	1.02	1.01	1.00	.99
Labour	NPV	3.43	2.71	1.99	1.26	.54	(.18)	(.91)
	BCR	1.06	1.05	1.03	1.02	1.00	.99	.98
Purchases	NPV	3.13	2.51	1.88	1.26	.64	.02	(.60)
	BCR	1.05	1.04	1.03	1.02	1.01	1.00	.99
Fuel	NPV	4.06	3.13	2.20	1.26	.33	(.60)	(1.54)
	BCR	1.07	1.05	1.04	1.02	1.00	.99	.97
Sales	NPV	(8.06)	(4.95)	(1.84)	1.26	4.37	7.48	10.59
	BCR	.87	.92	.96	1.02	1.07	1.12	1.17

Variable		Financial Analysis						
		-15%	-10%	-5%	Base Case	+5%	+10%	+15%
Discount Rate	NPV			(2.29)	(2.97)	(3.38)		
	BCR			.97	.96	.93		
Structure	NPV	(1.61)	(1.06)	(2.52)	(2.97)	(3.43)	(3.89)	(4.34)
	BCR	.98	.97	.96	.96	.95	.94	.93
Labour	NPV	.17	(.88)	(1.93)	(2.97)	(4.02)	(5.07)	(6.12)
	BCR	1.00	.98	.97	.96	.94	.93	.91
Purchases	NPV	(1.11)	(1.73)	(2.35)	(2.97)	(3.60)	(4.22)	(4.84)
	BCR	.98	.97	.96	.96	.95	.94	.93
Fuel	NPV	(.18)	(1.11)	(2.04)	(2.97)	(3.91)	(4.84)	(5.77)
	BCR	.99	.98	.97	.96	.94	.93	.92
Sales	NPV	(12.30)	(9.19)	(6.08)	(2.97)	.13	3.24	6.35
	BCR	.82	.86	.91	.96	1.00	1.05	1.09

Note: Figures in brackets denote negative values.

14.0 Marketing Facilities

14.1 Project Description

In Nova Scotia seasonal livestock auction sales provide a marketing framework for producers and are instrumental in establishing a pricing regime for all livestock sold in the province. During preparation of the Subsidiary Agreement it was determined that the then current facilities, which were owned and operated by a producer organization, were inadequate to handle the volume of production and would certainly require expansion in the very near future. Hence, a marketing facilities project was defined with the objective of upgrading and improving livestock marketing facilities in the province as part of an effort to maximize sales returns.

Specifically, the primary objective of the project is to upgrade seasonal livestock auction sales' facilities with particular emphasis on the buildings in Truro. A secondary project objective appears to have been to construct a beef bull testing station at Nappan. A five-year total expenditure of $100,000 was planned for this project.

14.2 Project Performance

The benefits generated by the improvement in facilities funded by this project are not readily quantified. Hence the application of cost-benefit analysis to this project was not attempted.

Spending during the four years covered in this evaluation is summarized in Table 14-1.

Table 14-1

Expenditure Under the Marketing Facilities Project in the Agriculture Subsidiary Agreement

1976	1977	1978	1979	Total
$19,658	$21,306	$22,192	$17,935	$81,091

The total expenditure shown represents slightly more than 81 percent of the total five-year planned expenditure for this project. Spending has taken place on the marketing facilities in Truro and at the research centre at Nappan near Amherst.

Expenditure in Truro has been aimed at improving and upgrading the livestock sales facility. Among the improvements made are the installation of a ceiling, installation of a new scale, gates for stalls, installation of an office, installation of washroom facilities, installation of cement floors in cattle buildings, insulating of a sales barn, installing water lines, constructing gates for sheep sales, and purchases of a mobile refrigerator display trailer for marketing promotion of pork, beef and lamb. An important consequence of all of this activity is that the livestock sales facility is now able to operate on a year round basis. This represents a significant step in increasing the capacity of the operation to handle expanded livestock production. It should also strengthen the marketing framework and pricing system operating in the province, a step which cannot fail to strengthen provincial livestock operations.

The second major activity undertaken by the project was the construction (1976) and subsequent upgrading (1978) of a Beef Bull Testing Station at Nappan. Construction was financed by a $12,500 grant from the project along with grants from the New Brunswick and Prince Edward Island governments and from the producers. This station does testing on the rate of gain and performance of producer owned bulls. The improvements carried out in 1978 enabled an expansion in the number of tested bulls that can be sold.

Lack of quantitative information on the impact of this project prevents any evaluation of it on economic efficiency grounds. However, it does appear that the project carried out tasks which are directly related to its initially stated objectives, and the improvements made will serve to strengthen livestock production and marketing in Nova Scotia.

15.0 Technology Adoption

15.1 Project Description

The major concern which prompted the creation of this project was the wide variability of productivity on Nova Scotia dairy farms, ranging from 8,000 pounds to 16,000 pounds per cow average. It was felt that increasing productivity at the lower end of this range would improve the viability and enhance the overall stability of the dairy industry in Nova Scotia.

Thus, the main purpose of this project is to increase efficiency of animal units through the provision of dairy herd testing, performance services and management systems. These would include milk recording systems, such as Dairy Herd Analysis Service, Record of Performance Service and Feed Analysis.

Funds under the project assist in providing these services to dairy farmers, including the costs associated with provincial farm service extension personnel. Total planned expenditure over the five-year period is $100,000.

15.2 Project Performance

Most of the activities undertaken under this project are aimed at increasing productivity through better on-farm management of animals. A quantitative evaluation of the various sub-projects would require substantial detailed data from the participants and then involve a large amount of analysis. Given that such data are not available in a readily usable form and the overall size of the project does not warrant a large expenditure of resources for evaluation, this was not attempted.

Actual expenditure for the four year period covered in this evaluation are summarized in Table 15-1.

Table 15-1

Actual Expenditure by the Technology
Adoption Project under the Agriculture Subsidiary Agreement

1976	1977	1978	1979	TOTAL
-	$107,642	$10,478	$8,821	$126,941

It is obvious that this project has overspent the original $100,000 allocation planned for it. Concerning 1976, although no spending is shown the project did have some activity, the costs of which were covered under other provincial programmes.

Actual project expenditure commenced in 1977 with the purchase of equipment to assess the protein content in the milk produced by provincial dairy herds. Such information is important now that 2% and skim milk have become much more popular. This equipment was installed at the Nova Scotia Agriculture College to serve dairy herds throughout the province. A second piece of equipment was also purchased to count somatic cells in milk as part of an attempt to develop a sound mastitis extension and control programme. In 1978, attention was turned to the development of a computer programme to analyze the causes of infertility among the province's dairy herd, this problem being one of the major reasons for cows being culled from herds. The infertility analysis was continued in 1979. Three other small sub-projects were carried out in 1979 dealing with transplanting embryos from outstanding animals to other hosts, development of a computer programme for Swine Herd health to assess herd performance and an artificial insemination project for swine. The last two projects evidently represent a shift in the objectives of this Project from what was originally intended.

From this brief review of the activities undertaken under this project, it seems clear that with the exception of the swine related sub-projects, the overall thrust has been towards satisfying the objectives originally specified. Whether the benefits created through the programme justify the costs incurred we are unable to say at this time.

16.0 Innovative Demonstration

16.1 Project Description

Transfer of agricultural research and the application of new technology is essential to the improved productivity, efficiency and profitability of farming. The best results can be achieved by the direct involvement of producers in testing and demonstrating technological change under commercial production conditions.

Therefore, the main thrust of this programme is to provide assistance with on-farm demonstrations and localized demonstration projects. The programme embodies the following objectives:

a) the transfer of technology from the basic research stage to commercial application;

b) to demonstrate the applicability of existing technology to the Nova Scotia situation; and,

c) to test modifications to the technology to determine suitability to Nova Scotia conditions.

The estimated five year cost of the programme was $1 million to be divided as follows:

Federal Share	Provincial Share
$800,000	$200,000

16.2 Project Performance

This programme is comprised of an extremely wide variety of projects. For the most part these projects can be considered as exercises in applied research. To assess the benefits and costs of this programme would require far more information than that which is currently available. Furthermore, in many instances it is not possible to quantify the benefits in that the projects have no commercial application as of yet. There do exist individual projects which have been adapted to commercial purposes and hence have associated costs and benefits. However, data on the uptake of these projects is not available in a manner suitable for evaluation purposes. An interesting point to note about this programme is that failures can prove to be as worthwhile as project successes. That is to say, one learns by his mistakes.

Actual expenditures for the four year period covered in this evaluation are summarized in Table 16-1. After the first four years, 62 percent of the targeted amount of $1 million has been spent.

Table 16-1

Expenditures on Innovative Demonstration
1976 - 1979

1976	1977	1978	1979	Total
$88,966.21	$192,097.77	$179,004.33	$161,841.25	$621,909.56

As mentioned, the range of projects started under the Innovative Demonstration Programme is very wide. Projects ranging from land clearing techniques to new technology in fruit production have been implemented. Not only are benefits and costs difficult to assess from this array, but so too are the timing of these benefits and costs. Many of these projects are on-going and will require a greater length of time to evaluate.

Undoubtedly the Innovative Demonstration Programme has stimulated some interesting and worthwhile projects. However, from the perspective of an evaluation it is not possible to assess the programme in a cost-benefit sense. Thus we are unable to say whether or not the benefits created can justify the costs incurred.

CHAPTER FOUR

4.0 Economic Impact of the Agricultural Subsidiary Agreement

4.1 Measures of Impact

One implication of project implementation that is often of interest is the number of jobs created and the associated income generated. As discussed in Chapter Two, this type of information is not new; rather it simply focuses on a particular aspect of a project to the exclusion of all other aspects. Moreover, by themselves the income and employment numbers do not provide a basis on which to judge whether a particular project is viable or to choose the more viable of any two projects. Furthermore, it should be remembered that the employment and income aspects of each project have been taken into account in the cost-benefit analysis reported previously.

In this study, what we are calling the economic impact of the Agricultural Agreement is reported in terms of two variables: income received by labour and the number of full-time job equivalents. The values for these variables reported below are calculated on an incremental basis. That is, an estimate is made of the proportion of Agreement activity that can be directly attributed to the existence of the incentives offered. To do this, incrementality proportions are determined from the information contained in the Sample Survey. For projects not included in the Survey, their incrementality is estimated on the basis of the economic circumstances in which they were implemented, as determined by analysis of the sector and/or interviews with knowledgeable people.

The economic impacts of the construction phase and of the operation phase of projects implemented under the Agreement are dealt with separately. This is done because construction is a short-term activity - except for the

Grains Storage Unit at Steam Mill, all of the construction activity undertaken in connection with the Agreement has a duration of not more than one year. In this interim evaluation aggregate, construction employment and aggregate construction labour income are estimated for each of the four completed years of the Agreement.

On the operations side, a different approach is taken. The incremental employment and income generated by the projects once they become operational is estimated for one year. Unlike construction, this employment and income may be expected to continue from year to year into the future. However, it should be noted that the sharp agricultural price fluctuations that frequently occur could lead to substantial fluctuations in employment and incomes. Hence, the estimates reported should be regarded as indicative only. Even so, because the operations phase impacts are on-going, they do provide the basis of the additional strength injected into the rural economy of Nova Scotia through the Agriculture Agreement.

4.2 Construction Impact

To estimate the construction impact, the first step is to identify those projects with a construction component. A review of the projects indicated that Land Clearing and Improvement, Feed Facility Incentive, Central Grain Storage Unit, Hog Production Incentive, Manure Storage Incentive, Marketing Facilities, Bulk Bins, Greenhouse Incentive, and Innovative Demonstrations all involved construction in varying degrees. For these projects, the total value of construction undertaken was estimated. Where the actual value of construction was known this was used. For the other cases, the value of the grants made was grossed up according to the proportion that grants bore to total expenditure. Where this proportion differed from its maximum value under the Agreement, the value used was determined from the Survey. The incremental part of total construction expenditure, that is the part that occurred only because of the incentives, was estimated next. Detailed information on the labour content of construction was not available for every project. Hence, it was assumed that labour income accounted for 35 percent of the gross value of construction. The number of incremental full-time job equivalents was then derived by dividing the incremental gross value of construction by the average annual construction wage according to Statistics Canada data on the construction industry. These job equivalents are regarded as the Direct Employment generated by construction activity under the Agreement.

There are additional impacts. These arise in two ways. Indirect Income and Indirect Employment are generated through the purchase of goods and services used in the construction process. Induced Income and Induced Employment are generated through the respending of Direct and Indirect incomes. To estimate values for these secondary affects, the income generated multiplier for construction in Model 2 of the 64 Sector Nova Scotia Input Output System was identified. Its value is 0.672. Multiplying the incremental gross value of construction activity by this value yields an estimate of the Total Income Generated - Direct, Indirect and Induced. Subtracting the value of Direct Income calculated previously therefore gives the sum of Indirect and Induced Incomes. Assuming the same wage dividing this income value by the same wage rates used in the calculation of Direct Employment provides an estimate of Indirect plus Induced Employment. This estimate should be regarded as a maximum since the Input Output System multipliers are indicative of long run results and the construction activity reported here is short run in nature.

Using the methods just described, the aggregate incremental employment impact of the construction phase of projects undertaken during the first four years of the Agreement are reported in Table IV-1. The associated aggregate incremental Income Impact of the construction phase is given in Table IV-2.

Table IV-1

Aggregate Incremental Construction Employment Per Year Due to Agriculture Agreement (Full Year Job Equivalents)

	1976	1977	1978	1979
Direct Jobs	109	165	221	176
Indirect plus Induced Jobs	100	148	198	157
Total Jobs	209	313	419	333

Source: Derived According to Explanation in Text.

Table IV-2

Aggregate Incremental Labour Income Per Year Due to Construction Activity Under the Agriculture Agreement ($'000)

	1976	1977	1978	1979
Direct Income	1,478	2,405	3,459	2,991
Indirect plus Induced Income	1,456	2,280	3,247	2,827
Total Income	2,934	4,685	6,706	5,818

Source: Derived According to Explanation in Text.

4.3 Operation Impact

Similar to the construction, the first step is to determine which projects actually result in expanded agricultural production and hence additional income and employment on farms. The following project activities were identified: Land Clearing and Land Improvement, Grain Incentive, Hog Production Incentive, Sheep Production Incentive, Tree Fruit Incentive, Bulk Bins Incentive, Refrigerated Container Incentive and the Greenhouse Development Incentive.

Two qualifications apply to projects in this list. First, realizing increased production from trees planted under the Tree Fruit Incentive may take as long as seven years from the time of planting. Hence, the incremental employment and income attributed to this project is based on the additional labour required to tend the expanded orchards, even though some of them may not actually be producing fruit yet. To the extent that expanded fruit production, when it occurs, will generate a higher demand for labour, the employment and income estimates here will understate the true impacts. The second qualification concerns Refrigerated Containers. The containers themselves do not generate employment. Instead they ensure that Nova Scotia blueberry growers (and to/or lesser extent, apple growers) have access to the European market. This has enabled the blueberry growers to expand their production significantly. We have attributed a 1,940 acre expansion in growing area and the associated output increase to the existence of the 40 additional refrigerated containers acquired with assistance under the Agreement.

The remaining steps required to produce the income and employment estimates are similar to those followed for Construction. The increase in the Gross Value of Output Produced flowing from farms assisted through the Agreement is calculated using the increase in productive capacity, yield and price assumptions adopted in the Cost-Benefit Analysis. Not all of this output can be attributed to the Agreement since some of the production expansion would have occurred anyway. Hence, the Gross Value of Output Produced is adjusted according to the incrementality proportions identified previously. The Incremental Gross Value of Production attributable to the existence of the incentives provided under the Agreement is estimated at $16.8 million. This is an annual value based on the level of production that would occur on all farms assisted once they reach full production (except for Tree Fruits as noted).

On-farm labour may be supplied by the farmer, members of his family or hired labour. To complicate matters, the farmer provides pure labour service, managerial talent and entrepreneurial skills to operate the farm. Dividing the farmer's net income according to the value of the three services mentioned is exceptionally difficult and is not attempted here. Instead, all labour services are lumped together and the income they earn is called the Return to Labour. Between 1976 and 1979 the average Return to Labour ranges between 35 percent and 41 percent of the value of Gross Farm Income in Nova Scotia. In this study a value of 38 percent is used. Assuming that the average and marginal Return are equal, the Incremental Gross Value of Farm Production is multiplied by this value to produce the estimated Return to Labour. This figure is reported as Direct Income in Table IV-3. Next, assuming an average full-time annual wage of $9,000 in agriculture, the incremental number of full-time job equivalents (Direct Employment) created by operation of projects financed by the Agreement is derived by dividing the wage into the Return to Labour.

Next, the Total Income Generated as a result of an increase in the Gross Farm Income is calculated as Incremental Gross Value of Farm Output multiplied by the Agriculture sector income-generated multiplier (= 0.644), taken from the Nova Scotia Input-Output System Model 2, 64 Sectors. Subtracting Direct Income from this figure yields an estimate of Indirect plus Induced Income. Assuming that the $9,000 wage figure still applies, the Indirect and Induced full-time job equivalents attributable to operation of Agreement financed projects is computed by a final division.

The results of all these calculations are presented in Table IV-3. The key assumptions that must be remembered to interpret this Table are: the incremental addition to agriculture productive capacity financed by the Agreement during 1976-1979 inclusive has attained full operation; the price and yield pattern prevailing in 1978-1979 applies, and only the truly incremental income and employment (that is, which results from activity actually induced by the incentives offered) is included.

Table IV-3

Aggregate Income and Employment Attributable to the Operation of Subsidiary Agreement Financed Expansion in Productive Capacity of Nova Scotia Agriculture

	Employment[1]	Annual Income[2] ($'000)	NPV[3]
Direct	331	4,625	36,184
Indirect and Induced	241	3,282	25,677
TOTAL	572	7,907	61,861

Source: Calculated according to the discussions in the text.

Note: 1. Measured in Full Year Job Equivalents

2. Assumes projects have reached full operation in year 5.

3. Net Present Value of annual income generated over a sixteen year period.

CHAPTER FIVE

5.0 Overall Assessment

5.1 Introduction

The broad objectives of the General Development Agreement and the Agriculture Subsidiary Agreement have been set out in Chapter One. Contained in Chapter One as well were a list of the programmes and projects undertaken, a brief description of the basis upon which these were chosen and an indication of the relationship which they bore to one another.

This overall assessment will address, in brief, the degree to which the programmes/projects contributed to the achievement of the objectives of the General Development Agreement. We have approached the matter by examining the relationship between the GDA objectives and the impact of the programmes/projects implemented on two levels:

a) in the abstract by determining whether, in principle, there was any incompatibility or inconsistency between Sub objectives, strategy and the programmes/projects which flowed from that strategy and the GDA objectives which, from the outset, would have prevented the achievement of the latter; and,

b) in concrete terms by examining the practical implications of the programmes/projects as implemented.

5.2 Development Opportunities

The matter of compatibility and consistency of objectives and the means of achieving those objectives is easily disposed of. In our view the objectives of the Sub are without question consistent with the development goals set out in the GDA. Likewise, the strategy which formed the basis of the programmes/projects implemented through the Sub, in principle, could be expected to contribute to the achievement of these objectives. Having said this, however, a cautionary note should be added concerning this strategy.

The approach which was used to identify opportunities for agricultural expansion and development was to proceed on the basis of import substitution with lesser emphasis placed on export markets. Specific opportunities were identified on the basis of a commodity analysis using a balance sheet approach. As noted above, in principle, there is nothing wrong with this approach provided the projects chosen to implement the strategy meet established investment criteria (see Chapter Two). In other words, simply because a region is deficient in production of a given commodity, there is no guarantee that that commodity can be produced efficiently, even though that region may have the necessary resources for production. While resource availability may be a necessary condition for efficient production it is by no means a sufficient condition. Projects must meet established investment criteria if the goals of "viable long term employment" and "increase in earned incomes" as specified in the GDA objectives are to be achieved.

Development opportunities were found to exist in three categories:

a) meat production (pork, beef, mutton and lamb);
b) high energy and protein crops (feed grains);
c) horticultural crops (apples, blueberries, etc).

Sixteen specific programmes/projects were defined and implemented. These programmes/projects were designed to be highly complementary and were meant to provide a balanced approach to eliminating the constraints which prevented a more rational use of the agricultural resource base. In principle the approach was a sound one, although, as a practical matter, some of the targets were perhaps somewhat optimistic. This is not simply a retrospective observation but reflects the views of departmental officials directly involved with programme formulation.

We have attempted to show how the objectives, strategy and individual programmes/projects were related by providing a matrix which illustrates the degree of integration intended. This is shown in Figure V-I. It should be noted that the matrix is presented purely as a descriptive device, not as an analytical tool. The consultants were not asked to assess whether more or less project integration would have been desirable. As indicated, four major groups of projects and impacts have been defined, the first three of which are articulated in the Sub.

a) Development opportunities summarize the sectors where agricultural output could realistically be expanded based on a commodity-by-commodity analysis of provincial and regional self-sufficiency and export opportunities and facilities. There are three major headings within the group.

b) Strategy elements to move towards taking advantage of the development opportunities in (a) above, comprising four major headings.

c) The actual projects or programs which comprise the main body of the Sub and which fall logically into headings defined in (a) and (b) above.

d) An "external" group of impacts made up of the institutional (federal, provincial, municipal) factors and environmental considerations. The federal and provincial components refer largely to the activities of various arms of government which affect the agricultural sector and rural areas more generally. The municipal component refers to the effects of Rural Development Plans whether actually adopted or not as policy. The rural development and environmental components attempt to summarize the socio-economic (societal) and physical ramifications of the headings in (a), (b) and (c) as well as the governmental impact in this respect.

There are three degrees of integration or impact:

a) a circle with a cross implies "primary" integration of projects;

b) an open circle implies "secondary" integration of projects;

c) a blank cell (other than on the main diagonal) implies little or no integration of projects.

As well as degree of integration or impact the direction of impact is assessed by reading vertically; that is, degree of integration need not be symmetrical or reciprocal. It should be remembered that Sub programmes are, with the except-

Figure V-1

Project Integration Matrix

DEVELOPMENT OPPORTUNITIES | ELEMENTS | PROGRAMS OF SUB | EXTERNAL

	PROGRAMME / PROGRAMME	HEAT PRODUCTION	HIGH ENERGY AND PROTEIN	HORTICULTURAL	EXPANSION OF LAND BASE	OPERATION DEVELOPMENT	HUMAN DEVELOPMENT	TRAINING AND TECHNOLOGY	LAND CLEARING AND DEVELOPMENT	LAND CONSOLIDATION	HIGH ENERGY AND PROTEIN CROPS	FEED FACILITIES	CENTRAL GRAIN STORAGE	N.S. GRAIN COMMISSION	BEEF PRODUCTION	HOG PRODUCTION	SHEEP PRODUCTION	PUREBRED SHEEP STOCK	MANURE STORAGE	MARKETING FACILITIES	TECHNOLOGY ADOPTION	TREE FRUITS	BULK BINS	REFRIGERATED CONTAINERS	GREENHOUSE DEVELOPMENT	INNOVATIVE DEMONSTRATION	RURAL DEVELOPMENT	FEDERAL PROGRAMS	PROVINCIAL PROGRAMS	MUNICIPAL PROGRAMS	ENVIRONMENTAL
DEVELOPMENT OPPORTUNITIES	HEAT PRODUCTION		⊗		⊗	⊗	○	⊗	⊗	⊗	⊗	○	⊗	⊗	⊗	⊗	⊗	⊗	○	⊗	○					⊗	⊗	⊗	⊗	○	⊗
	HIGH ENERGY AND PROTEIN CROPS	⊗			⊗	⊗	○	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	○	○		○					⊗	⊗	⊗	⊗	○	⊗
	HORTICULTURAL CROPS				○	○		⊗	○	○												⊗	⊗	⊗	⊗	⊗	○	⊗	⊗	○	⊗
ELEMENTS	EXPANSION OF LAND BASE	⊗	⊗	○		○	○	○	⊗	⊗	⊗	○	○	○	⊗	⊗	⊗		○	○	○	○			○	⊗	⊗	○	⊗	○	⊗
	OPERATION DEVELOPMENT	⊗	⊗	○	○		○	⊗	⊗	○	⊗	○	○	⊗	⊗	⊗	⊗	⊗	○	○	○	○	○	○	○	⊗	⊗	○	○		⊗
	HUMAN DEVELOPMENT	○	○	○	○	○		⊗	○	○	⊗	○	○	○	⊗	⊗	⊗	○			○	○			○	○	○	⊗	⊗		
	TRAINING AND TECHNOLOGY	○	⊗	⊗	○	○	⊗		○	○	⊗	○	○	○	○	○	○	⊗	○		⊗	○	○	○	○	⊗		⊗	⊗		
PROGRAMS OF SUB	LAND CLEARING AND DEVELOPMENT	⊗	⊗	○	⊗	○	⊗	○		⊗	⊗	○	○	⊗	⊗	⊗	○		○		○	○			○	○	⊗	○	⊗		⊗
	LAND CONSOLIDATION	⊗	⊗		⊗	○	○		⊗		○		○	⊗	⊗	⊗	⊗		○		○	○					○	○	○		○
	HIGH ENERGY AND PROTEIN CROPS	⊗	⊗		⊗	○	⊗	○	⊗	⊗		⊗	⊗	⊗	⊗	⊗	⊗	○	○		⊗					⊗	⊗	○	⊗		⊗
	FEED FACILITIES	○	⊗			○	○	○			⊗		⊗	⊗	⊗	⊗	⊗				○					○	○	○	○		○
	CENTRAL GRAIN STORAGE	○	⊗			○	○		○	○	⊗	⊗		⊗	⊗	⊗	⊗									○	⊗	○	○		○
	N.S. GRAIN COMMISSION	○	⊗			○	○		○	○	⊗	⊗	⊗		○	○	○											○	⊗		
	BEEF PRODUCTION	⊗	⊗		⊗	○	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗		○	⊗	○	⊗	⊗	○					○	⊗	⊗	⊗	○	⊗
	HOG PRODUCTION	⊗	⊗		⊗	○	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	○		⊗	○	⊗	⊗	○					○	⊗	⊗	⊗	○	⊗
	SHEEP PRODUCTION	⊗	⊗		⊗	○	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	○	○		⊗		⊗	○					○	⊗	○	○		
	PUREBRED SHEEP STOCK	⊗	○					○	○		○	○	○	○			⊗			⊗	○					○		○	○		
	MANURE STORAGE	⊗	○					○	○	○	○				⊗	⊗	○				○					○	○	○	○	⊗	⊗
	MARKETING FACILITIES	⊗												○	⊗	⊗	⊗	○										○	○	○	
	TECHNOLOGY ADOPTION	⊗	○				⊗	⊗	⊗		⊗	○	○	○	○	○	○	⊗								⊗		○	⊗		
	TREE FRUITS			⊗	○	○	○	⊗	⊗	○													⊗	⊗		⊗	⊗	⊗	○		⊗
	BULK BINS			⊗				○	○	○												⊗		⊗	○	○		○	○		
	REFRIGERATED CONTAINERS			⊗				○														⊗	⊗		○	○		⊗	○		
	GREENHOUSE DEVELOPMENT			⊗		○	○	○															⊗	⊗			○	○	○	○	○
	INNOVATIVE DEMONSTRATION	○	⊗	⊗	○	○	⊗	⊗	⊗	○	⊗	○	○		○	○	○	⊗	○		⊗	⊗	○	○	○		○	⊗	⊗		○
EXTERNAL	RURAL DEVELOPMENT	○	⊗	○	⊗		○		⊗	⊗	⊗			○	⊗	⊗	⊗		⊗	○		⊗			○			⊗	⊗	⊗	○
	FEDERAL PROGRAMS	⊗	⊗	○	○	○	○	○	○	○	⊗	○	○	⊗	⊗	⊗	⊗	○	○	○	○	○	○	○	○	○	○		○	○	○
	PROVINCIAL PROGRAMS	⊗	⊗	○	⊗	○	○	○	⊗	⊗	⊗	○	○	⊗	⊗	⊗	⊗	○	○	○	○	○	○	○	○	○	⊗	⊗		⊗	⊗
	MUNICIPAL PROGRAMS	○	○	○	⊗				⊗	⊗	⊗				⊗	⊗	⊗		⊗			⊗			○		⊗	○	⊗		⊗
	ENVIRONMENTAL	○	○	○	○				○	○	○				○	○			○			○					○	○	○	○	

tion of the Nova Scotia Grain Commission, Central Grain Storage Marketing Facilities and Refrigerated Containers programmes, enterprise specific; they are aimed at individual farmers. This injects an element of uncertainty which makes macro analysis difficult. The matrix tends to treat integration at the macro (provincial) level with the exception of such programs as feed facilities, manure storage and bulk bins which are treated at the farm level.

The matrix is almost symmetrical around the main diagonal although this symmetry is not necessarily echoed in degree of integration or impact. Integration between specific elements or groups of programs is more noticeable with respect to meat production, high energy and protein corps incentives and land development. Horticultural programs tend to be much more independent from other programs. In many respects, however, it appears that the Sub was designed to effect a high degree of complementarity between the different elements and opportunities, specifically in two ways.

a) between the land development, meat production and high energy and protein groups to satisfy provincial markets;

b) between the different items in the horticultural group to promote proven production for export from the province.

The innovative demonstration programme caters essentially to individual research and adoption needs to satisfy specific scientific and technological projects.

The external factors cannot be easily ignored or categorized; they tend to be all-pervasive and all-embracing and reflect past as well as present policies and programs which affect the overall rural environment. The direction of influence is often quite unbalanced; for example, federal programs are much more likely to influence municipal programs than _vice-versa_.

To conclude, our assessment at the abstract level of principle and policy indicated that the strategy adopted, and programmes/projects which flowed from that strategy, were consistent with the objectives of the GDA. The matter of assessment thus comes down to a more concrete level. Were the programmes/projects sound in economic terms? Has their implementation contributed to the achievement of the GDA objectives?

5.3 Contribution to GDA Objectives

5.3.1 Approach

Our approach to assessing the overall impact of the Sub in practical terms has two dimensions. First, examination of the economic efficiency of programmes/projects is required. In general terms this aspect addresses the basic question posed earlier, Does the programme or project meet the established investment criterion? Second, an assessment of the effectiveness of programmes/projects is required. This aspect addressed relative impact in terms of employment and income. This area of enquiry is of secondary importance as a criterion for accepting or rejecting a given project, although it can provide a basis for choosing from a number of projects whose economic efficiency characteristics are similar. For example, in an area of high unemployment, other things being equal, one would choose the project which was more labour intensive.

5.3.2 Economic Efficiency

The question of the economic efficiency of programmes/projects was dealt with in great detail in Chapter Three. With few exceptions the projects satisfied the investment criterion set out in Chapter Two, i.e., a positive net present value at a 10 percent discount rate. That a number of projects did not meet the performance targets established in the Sub was of little consequence in so far as their own acceptability was concerned since the analysis in each case turned on the investment actually made, not on what was intended. The fact that targets were not achieved says less about their realism than the sheer problem of setting meaningful targets where their achievement depends on factors over which there is so little control, including private decision making in the context of uncertainty over output prices and input costs.

The relationship between targets and actual performance was a significant factor from the perspective of programme integration, however, where the economic performance of one project was linked directly to output from another. This problem arose in the case of the Central Grain Storage Unit where economic performance was linked directly to grain production. The grain incentive programme achieved only 27 percent of its target production by the time the Grain Storage Unit came on stream. As noted in the economic evaluation of the Unit, this has meant that considerable excess capacity exists which has had an adverse effect on that project's economic performance.

This is in part a technological problem since there are certain economies in operating a facility of that size instead of two facilities each half that size. This problem was avoided in the case of refrigerated containers, for example, where investment could be adjusted over time to meet the capacity requirements dictated by actual production.

In terms of economic efficiency, then, our analysis of specific projects indicates that most projects made a positive contribution to the achievement of the GDA objectives. The land clearing and improvement, feed facilities, hog and sheep production, manure storage, and refrigerated containers incentive programmes have encouraged the expansion and maintenance of viable, long term employment opportunities and have increased the earned incomes of Nova Scotians. These programmes have generated viable economic activity which probably would not have occurred otherwise or would not have occurred as soon.

This is not to suggest that other programmes have not made a worthwhile contribution. Beef production is a good example. There is little question that beef production provides a valuable source of income for a number of relatively more efficient producers. For structural seasons, however, the industry is not efficient when assessed in terms of the criterion used in this analysis. Producers in Nova Scotia will, on average, find it very difficult in the long run to generate a rate of return on investment which exceeds 10 percent in real terms.

In support of the general conclusions reached in this overall assessment of performance, we have included an updated version (Table V-I) of the commodity balance sheet which appeared in Chapter One. As indicated, production for the domestic market in all categories but beef has increased. In most categories there has been an increase in the proportion of total consumption accounted for by local production. This is encouraging since consumption has been steadily increasing. This is not to suggest, however, that elimination of the gap should become an end in itself. The economics of import substitution are not always favourable.

5.3.3 Economic and Social Impact

It is difficult to be more precise on the matter of the degree to which the projects have contributed to the achievement of the DGA objectives than to say that the employment and income impacts have been positive and can be expected to continue to be positive for the foreseeable future. The employment and income impacts were presented in quantitative terms in Chapter Four. These were aggregate figures. No attempt was made to compare projects on the basis of relative impact in terms, say, of employment or income per dollar of incentive provided.

It is likewise very difficult to be specific on the extent to which the programmes have contributed to the broader social objectives of the GDA. Over the past decade there has been a reversal of the trend of declining agricultural

Table V-1

Balance Sheet for Selected Agricultural Products, Nova Scotia
1973 and 1978/79

	1973			1978/79		
	Production	Consumption	Surplus (Deficit)	Production	Consumption	Surplus (Deficit)
Meat						
Pork ('000 lbs)	16,062	43,543	(27,481)	21,722	51,970	(30,248)
Beef ('000 lbs)	16,258	60,770	(44,512)	15,364	65,026	(49,662)
Veal ('000 lbs)	1,051	2,150	(1,089)	1,418	1,610	(192)
Mutton/Lamb ('000 lbs)	664	1,964	(1,300)	700	1,526	(826)
Chicken/Fowl ('000 lbs)	24,406	26,912	(2,426)	32,957	30,606	2,351
Turkey ('000 lbs)	2,000	4,940	(2,940)	4,132	7,037	(2,905)
High-Protein Crops						
Grain	44	221	(177)	---------- Not Available	----------	----------
Horticultural Crops						
Apples ('000 bu.)	1,950	941	1,009	2,700	1,430	1,270
Blueberries ('000 lbs)	10,200	950	9,250	10,900	638	10,262
Strawberries ('000 qts.)	1,500	2,500	(1,000)	2,500	2,500	-

Source: Department of Regional Economic Expansion, Subsidiary Agreement, Agricultural Development Canada/Nova Scotia, 1976, pp. 18-19.

Nova Scotia Department of Agriculture and Marketing, Unpublished Estimates, 1979.

production. Although not wholly responsible for improvements in this sector, the Sub programmes have served to reinforce the pattern of activity and accelerate the rate at which improvements might otherwise have taken place. Our analysis indicates that the economic basis of this reversal is, for the most part, solidly grounded and should be sustained barring extremely adverse market conditions. In short, we feel that, given their sound economic footing, the programmes will strengthen the fabric of rural life in the Province.

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PROJECT PARTICIPANTS

Michael Gardner	Project Director Analysis
Thomas Pinfold	Methodology Analysis
Martin Walker	Research/Analysis
Maurice Mandale	Research/Analysis