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DIPP EVALUATION STUDY

VOLUME 1

APPENDICES TO COVERING REPORT

Peat, Marwick and Partners
Management Consultants

(Peat, Marwick, and Partners)

DIPP EVALUATION STUDY

VOLUME 1

APPENDICES TO COVERING REPORT

TERMS OF REFERENCE:

APPENDIX A TO THE COVERING REPORT

OF THE DIPP EVALUATION STUDY

DIPP EVALUATION STUDY

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I - INTRODUCTION

The DIPP Evaluation Study flowed out of the Evaluability Study conducted in 1979. The conclusion of the latter study identified the objectives for an evaluation study as follows:

- measure how well program objectives have historically been met, and how the fulfillment of one objective impinges on the fulfillment of other objectives;
- improve program effectiveness by incorporating analytical cause-effect findings into the selection of criteria and the determination of the program priorities;
- measure the validity of program rationales, and recommend changes to the program to reflect the validated rationales;
- examine the way DIPP funds are handled by companies' accounting systems and identify options for maximizing DIPP effectiveness through accounting requirements;
- estimate future market demands, examine reasons for success and failure in the past, and recommend an approach for future DIPP monitoring and control requirements;
- measure and recommend ways to improve program delivery effectiveness, efficiency, and control.

The final result of the evaluation will be a recommendation regarding the continuance of the DIPP program, and a set of recommendations for maximizing the value derived from money spent on the program. These results will be made available to management by March 31, 1980.

II - REFINED OBJECTIVES

Naturally, these objectives have been refined somewhat over time. The specific aims were formulated as a series of questions and hypotheses, listed below. Questions are identified as (Q); hypotheses as (H).

ECONOMIC BENEFITS

What is return on investment for DIPP projects? (Q)

What criteria best determines incrementality? (Q)

How many DIPP projects were incremental (would not have been undertaken without DIPP)? (Q)

What is the ROI on incremental projects? (Q)

What criteria/priorities should be applied to maximize ROI? (Q)

DEFENCE RATIONALE

DIPP contributes to Western/Canadian defence capability (H);

Defence industries would not exist without DIPP and/or product line would not exist (H);

DIPP improves ability of industry to maintain Canadian defence equipment (H).

COMPETING SUBSIDIES AND COUNTERVAIL RATIONALES

DIPP is required to match subsidies provided by foreign firms (H);

DIPP is necessary to allow defence or civil related products to enter the U.S. without countervail (H).

RISK

DIPP is required because high technology inherently involves high risk (H).

High risk is associated with high project profit (H).

CORPORATE DECISION-MAKING STRUCTURE

The nature of the relationship between subsidiaries and parents affects decisions on DIPP projects (H).

ATTITUDES TOWARD R&D

Firms operate on inflexible R&D budgets, so DIPP is required to fund new, promising opportunities (H).

HIGH TECHNOLOGY SPIN-OFF

There are long-term payoffs from investment in high-technology R&D. (H)

DEFENCE EXPORT POTENTIAL

Canada has a special relationship with the U.S which can be exploited through DIPP. (H)

DIPP and other defence export arrangements have aided Canadian industry. (H)

DIPP has increased the capability to participate in the offset arrangements and, possibly, vice-versa. (H)

CONCENTRATION OF FIRMS

Relatively few firms have received DIPP. (H)

DIPP firms have special characteristics which cause them to participate. (H)

MARKETING

There are significant inhibitors to marketing defence products in the U.S. which, even with DIPP, limit export potential. (H)

PROGRAM STRUCTURE

What are the differences in payoff among types of grants? (Q)

PROGRAM DELIVERY

The current delivery system does act as a filter. (H)

The current system substantially affects the nature of the submission. (H)

The current system operates according to its design specifications, but it does not address effectiveness, determined by incrementality and ROI. (H)

STRUCTURE OF THE EVALUATION STUDY

APPENDIX B TO THE COVERING REPORT

OF THE DIPP EVALUATION STUDY

STRUCTURE OF THE EVALUATION STUDY

APPENDIX B TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

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I - THE MODULES

This study was composed of eight operational modules:

- A series of seven major-case studies; these projects were allocated 59% of all DIPP funds in the financial year 1977-1978;

- A series of 31 R&D and 8 CA/SE mini-case studies; these projects were allocated an additional 4% of all DIPP funds in the same year;

- A mail-out questionnaire survey of over 115 firms;

- An interview/questionnaire survey of panels of technical experts regarding the major (7) and mini (31) case projects;

- An analysis of the particular problems and opportunities related to defence export marketing;

- Quantitative analysis (primarily statistical) of the data developed in the other modules;

- A study of the DIP Program and project management and operation.

- A study of competing subsidies and countervail and their relationship with the DIP Program.

II - MODULE DESCRIPTION

MAJOR CASE STUDIES

This module is organized to:

- review seven major DIPP-funded projects in depth (including on-site company visits, interviews, review of financial information, etc.);

- review and execute a discounted cash flow (DCF) analysis of each project as it appeared to the company at the time of inception. The DCF, supplemented by subjective review of risk, liquidity problems, etc., enabled an opinion to be formulated on incrementality. Incrementality is defined as whether or not the program would have been undertaken in the absence of DIPP assistance (and what level of assistance would be appropriate);

- review the actual results of all funded projects to date plus the estimates of future sales to determine economic costs, i.e., benefits less than resources would have earned elsewhere, and to determine the benefits of incremental projects, i.e., a DCF adjusted for economic externalities to yield the ROI. The net present value (NPV) and incrementality of projects were used as measures of project effectiveness;

- provide the information needed to arrive at generalizations on the common factors which contributed to the success or failure of the projects.

For example, it could perhaps be determined that linkage with a foreign marketing organization was crucial for military sales in all successful projects or that the interaction with a foreign parent resulted in failure on R&D projects, etc.;

- examine and assess risk, and its relationship to project success, through discussions held with senior company and departmental officials on the reasons for project success or failure; in particular, to identify which area of risk (market, technical, or financial) contributed to project success or failure, and to establish what the relationship was between the initial perceived risk and later project outcome;

- undertake a study of marketing capabilities and practices including a review of the logic and rationale of the market forecast made at the time of project inception, and a review of the validity of the market forecast being used for projects whose life cycle is not yet complete.

- examine the differences in the marketing activities between successful and failed projects in order to identify how these activities might relate to success, what the effect was of different inhibitors encountered by the projects, and how these problems were or were not overcome.

MINI CASE STUDIES

This module is organized to:

- conduct in-depth studies of a statistically valid sample of 39 smaller projects to provide generalizable observations on the same questions as in the major cases but using as data sources ITC files, questionnaire data, and brief discussions with Departmental and/or company officials.

- these results permitted the assessment of:
  - the extent to which DIPP funding has enabled projects to be undertaken which would not otherwise have been undertaken (Incrementality)
  - the extent to which funding has represented simply a transfer of funds from taxpayer to companies,
  - the economic costs of the benefits (ROI) of these projects.

USER SURVEY

The user survey was composed of two parts: a file search and mail-out/mail-back questionnaires. The purpose of gathering information was to provide data for:

(1) the analysis of the impact of DIPP funding on the program objective(s);

(2) the cost-benefit analysis of the case studies; and

(3) the statistical models.

The questionnaires were sent to 117 companies, selected from a complete list of DIPP funded companies. Approximately 50% of the companies returned completed questionnaires.

The data collected included measures of the technological capability of firms (technological and defence objectives) and the financial returns to investment (economic objective). Data gathered for the statistical model included a measure of project success (export rate, sales) and determinants of project success (relevant company and project variables).

Project file data on sales and investment supplemented the questionnaire to enable a comparison to be made of actual vs. forecast sales.

EXPERT OPINION

A panel of 77 experts in technology provided ratings of DIPP supported projects on scales measuring different technological and defence related aspects. The experts were asked to rate all the major and mini case projects. The data generated from the panel was used:

- to assess the meaning of objective measures of technology (e.g., percent of R&D in a project);

- to assess how well DIPP contributed to technological capability;

- to assign values to all projects in the statistical models on variables measuring the technological aspects.

Expert opinion also provided input into the examination of the relation of risk to technological and defence capability.

In addition, expert opinion was sought to provide some insight into the foreseeable future trends in defence technology.

MARKETING

Interviews with Canadian government officials (ITC, External Affairs, etc.), corporate officials, and U.S. government officials identified the factors inhibiting Canadian industry in seeking to export DIPP supported products, and the best ways of overcoming these inhibitors. Peat, Marwick, Mitchell & Co. in Washington concentrated on what it takes to sell products to the U.S. defence market. They examined general marketing requirements rather than those peculiar to selling Canadian products.

The "Canadian-specific" requirements and the requirements to sell overseas were identified mainly from corporate and governmental interviews and analyses conducted inside Canada. At the conclusion of this module, recommendations are made on the procedures for marketing both to the U.S. and to overseas markets, on the impact or importance of various inhibitors, and on procedures for overcoming these inhibitors in future marketing efforts.

QUANTITATIVE ANALYSES

This module examined the relationships between the economic, technological, and defence objectives. The user survey supplied objective data on the economic success of projects (exports, jobs created, ROI, etc.), technological characteristics (R&D intensity, percentage of scientists employed, etc.), and defence characteristics (e.g., defence or civil-related, sales to departments

of defence, etc.). The survey of expert opinion gave estimates of innovativeness, high technology status, contribution to defence capability, etc. The statistical analyses related these characteristics, so that we could examine the differences in economic success between projects varying in their technological and defence characteristics and outputs. For example, we examined the way in which the export sales depended on the innovativeness and R&D intensity of the project, and whether the ROI of the projects depended on whether the project is defence or civil-related.

Statistical and mathematical procedures for measuring risk based on the survey data were developed. In the analysis, risk was estimated and then statistically related to other characteristics and to project success. We then looked at what types of projects (e.g., certain kinds of technology, certain project sizes, etc.) were risky, and whether risk was in some way related to project success (again primarily economic). The extent to which a positive association between risk and success exists will then serve as a basic measure of the validity of the risk rationale for DIPP.

PROGRAM AND PROJECT MANAGEMENT AND OPERATION

This module comprised a review of the procedural steps executed by ITC to deliver the DIP Program and its constituent projects as defined by the DIPP Directive. While the main thrust was an examination of project files against the current ITC delivery mechanism and the control mechanisms defined in the directive, some external comparative work and review of previous analyses of the mechanism were undertaken where available.

The major components of this module were as follows:

Program Management: Policy establishment, division of responsibility, reporting evaluation feedback from operations, accountability at various levels in the Department.

Project Implementation: Examination of how a project proceeds from company application to contract phase, and the checks and balances within ITC. The implementation phase also included establishing the monitoring and control mechanism in program delivery.

Project Evaluation: The execution of the monitoring and control function, reporting, data base, with subsequent analysis and evaluation. Evaluation is perceived as an ongoing process in the project cycle as well as an end-of-project, ISB, and program function.

COMPETING SUBSIDIES AND COUNTERVAIL

This module examined the support given to foreign firms and the ways in which this support interacted with the decisions of DIPP firms. It was undertaken by means of a literature review, discussion with ITC officials, use of questionnaire data, and interviews with corporate officials.

THE DIP PROGRAM - BASIC INFORMATION

APPENDIX C TO THE COVERING REPORT
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THE DIP PROGRAM - BASIC INFORMATION

APPENDIX C TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

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INTRODUCTION

This appendix describes certain characteristics of the DIPP program and includes:

- a brief description and history of DIPP
- the organization of the program
- an analysis of DIPP expenditures over the last 20 years
- a description of the distributional characteristics of DIPP
- an examination of the sales-expenditure ratios of DIPP over the last 20 years
- a description of certain characteristics of DIPP's program delivery system.

I - THE DIP PROGRAM IN CONTEXT

DIPP is an industrial assistance program operated by ITC. It is the oldest program of the Department, having arrived via the Department of Industry from the former Department of Defence Production, where it started in 1959. It is one of the largest contribution program of ITC at $45-50 million per year, and it has provided some three-quarters of a billion dollars of assistance to industry over its first twenty years.

The current program directive opens with the words: "(DIP) Program operates in support of Canadian international defence co-operative agreements for research, development and production. Program support is directed to projects which will assist in maintaining the defence industry base in areas where Canada has special skills, to projects which support DND requirements and to

projects with significant potential for defence export sales, or sales to defence-related, civil export markets". The objective is to develop and sustain the technological capability of the Canadian defence industry for the purpose of generating economically viable defence exports and related civil exports.

PROGRAM COMPONENTS

Three types of aid are provided under the auspices of the DIP Program:

a) Innovation project development, for new products for export, generally called R&D projects. Funding is generally a 50% Crown Contribution

b) Capital Assistance, for upgrading Canadian manufacturing equipment in defence-related companies), generally called Capital Assistance projects. Funding is generally a 50% Crown Contribution plus a 50% interest free loan repayable over 5 years.

c) Source Establishment, for helping Canadian companies to absorb non-recurring front-end contract costs when competing against the U.S. defence industry, generally called Source Establishment projects. Funding is generally a 50% Crown Contribution.

The innovation sector now accounts for 69% of the dollar funding, and is allocated roughly equally to defence and to civil projects. Capital Assistance is half loan/half contribution, the loan portion being repayable and interest free for five years. Source establishment is a non-repayable contribution but is only payable to a company if it wins the specific contract.

HISTORY OF THE PROGRAM

The impetus for DIPP came from the cancellation of the Avro "Arrow" fighter program in 1959, when the government made a deliberate decision to end domestic development of major weapon systems. To maintain the defence technology base, and to support the Canada/US Defence Production Sharing Arrangements, it was deemed necessary to provide industrial assistance to replace the DND weapons development programs. The Product Research and Development program was established for this purpose. Later, a Capital Assistance program was instituted, followed by Source Establishment aid. With the signing of the Canada/U.S. Defence Development Sharing Agreement in 1963, the supporting institutional environment for defence research and development was significantly strengthened.

Originally, the Department of Defence Production (DDP) was selected to operate the programs which were to evolve into DIPP. The first major change came in 1968, when DDP was disbanded. The program was transferred to the Department of Industry (DOI), together with the program operators, the IDPB (International Defence Programs Branch). While the objectives did not alter, the atmosphere surrounding DIPP did. No longer did DIPP operate in a department dedicated to the defence environment. DOI was responsible for all Canadian industry. The various program elements were combined into a single program for the first time. Concurrently, certain specific industrial development opportunities in aerospace led to DOI recommending that the program be expanded to include defence-related, civil, high technology. By mid-1968, Cabinet approved the amalgamation of the program elements into DIPP and the expansion of the terms of reference to include "civil-related"

technologies. Thus, the original defence-oriented goals were augmented by civilian-oriented goals.

The major changes to the DIPP environment came within a year. DOI was merged with the Department of Trade and Commerce to form the Department of Industry, Trade and Commerce (ITC) and the program became part of the new department. Again, the basic objectives of DIPP remained unchanged, while the environment around it altered. Program control by now was firmly in the industry sector branches, though IDPB still chaired the DIPP Committee. The value of projects funded had risen rapidly from just under $2 million in 1959/60 to just under $50 million in 1969/70. In terms of resources available to the program, DIPP was at its peak at this time.

CHANGES IN THE 1970'S

The 1970 decade has seen a number of changes affecting the defence market, the Canadian defence position, and the position of DIPP within ITC. Sales of defence products (adjusted to constant dollars) to the U.S. fell by 50% between 1966 to 1973. Canada's defence spending, as a member of NATO, exceeded only Luxembourg's when expressed as a percentage of GNP. Acceptable projects for Canada/U.S., DPSA's joint development were still hard to find.

Early in the 1970's, the Industry Sector Branches assumed total control over the program. At this time, the ISB's chaired the DIPP Committee (having taken over from Defence Programs Branch); the DIP Program Office (External Services) reported to the ADM Industry and Commerce, and the ISB's delivered the projects to their industry clients.

By 1973, the central agencies were concerned about the ITC system for managing DIPP and the quality of the management of DIPP. With the approval from Treasury Board, an ADM, a Deputy Minister, and a Minister, ITC was restructured. DIPP program management was placed under one ADM, program delivery under a second ADM, and program marketing under a third ADM. The matrix system of management, the re-emphasis of the challenge system, and increased financial analysis of projects were all established. In 1977, the DIPP directive was rewritten to reflect these changes, one of which was the transfer of chairmanship of the DIPP Committee from the ISB's, to what is now the position of the ADM Finance.

In 1971, the years of deferred defence re-equipment came to an end. As DND began to re-equip with trucks, tanks, armoured cars, and patrol aircraft, so did defence exports to the US rise. They did not reach the levels of the late 1960's but were certainly above the lows of the mid-1970's. DIPP funding, which had peaked in real terms in 1969/70, then began to decline in absolute terms. This, coupled with accelerating inflation, left the program in 1978 with a little over half of its 1969/70 purchasing power. There is presently pressure from a number of areas to increase the level of funding to accommodate a larger number of projects. Thus, the comprehensive evaluation of DIPP is timely.

II - THE CURRENT DIPP ORGANIZATION

An overview of the organizational environment in which DIPP operates is provided below.

OTHER DEPARTMENTS

Three federal departments are involved with DIPP. It is completely an ITC program from the point of ownership and accountability; however, DSS is used for contract management on a fee-for-service basis; while DND provides military and technological advice and assistance. These other two departments have an impact at the decision stage and in monitoring and control.

From time to time, other federal agencies and departments may become involved. Examples include National Research Council, the Department of Transport, the Department of Communications. Their input is related to their particular technical expertise.

INTERNAL ITC STRUCTURE

Within ITC, there is a matrix management system. DIPP is divided between three ADM's.

The principal user ADM is the ADM Industry and Commerce Development. The program is a tool used by this group for industry development consistent with DIPP goals. The ADM Finance is the program manager. The ADM Trade Commissioner Service and International Marketing is a secondary user. His group uses DIPP as a tool of international joint projects in the military area. He is also the principal advisor in marketing.

Projects are recommended for approval, or rejected, or deferred by a DIPP Committee consisting of representatives of these ADM areas of ITC, plus DND

EXHIBIT 1

DIPP EXPENDITURES BY PROGRAM COMPONENT BY FISCAL YEAR 1959-78

Year	Capital Assistance $ million		Source Establishment $ million		R & D Innovation $ million		Total
1959/60	-		-		1.815		1.815
1960/1	-		-		2.902		2.902
1961/2	-		-		4.420		4.420
1962/3	-		-		8.000		8.000
1963/64	-		-		19.000		19.000
1964/5	0.394		0.080		20.500		20.974
1965/6	2.378		0.062		23.898		26.338
1966/7	7.626		9.374		22.626		30.626
1967/8	10.215		0.367		22.903		33.485
1968/9	5.425		2.925		21.237		29.587
1969/70	6.114		18.562		23.832		48.499
1970/1	6.656		12.952		25.578		45.186
1971/2	9.407		7.523		31.870		48.800
1972/3	5.582		13.022		29.721		48.325
1973/4	7.502		5.655		44.346		57.503
1974/5	6.865		5.832		35.733		48.430
1975/6	5.938		2.167		30.895		48.430
1976/7	5.509		2.273		37.118		44.900
1977/8	4.305		6.972		31.933		43.210
TOTAL	83.916	(14%)	78.766	(13%)	438.327	(73%)	601.000

Source: DIPP Program Office

and DSS. Each has quite distinct roles to play in the overall operation of DIPP, and this division of responsibilities has a fundamental influence on the DIPP delivery system. The specific implications of this structure are discussed in the sections on certain stages in the delivery system (Annex VII C) and in the section on conflicts in the system (Annex VII D).

POSITION VIS-À-VIS OTHER PROGRAMS

DIPP is not the only program of industrial assistance in ITC. Over the past years, several other programs have been introduced, tried, revised, and replaced. DIPP has endured. The terms and conditions under which these other programs operated have, it is reported, tended to be much less "flexible" than DIPP, and thus a tendency to use DIPP wherever possible has evolved. ("Flexible" here means there are more easily met eligibility criteria and a more comprehensive scope). Additionally, DIPP has tended to be a "richer" program, and industry has favoured it over other existing options. ("Richer" here means that there is no program "means test", and DIPP provides a greater percentage of benefits, on average.) Thus, the industry sector branches have viewed DIPP as a valued tool in their kit of industrial assistance programs. These several factors combine to have a marked influence on the perceptions of the people and thus on the program delivery system for DIPP.

III - OVERALL DIPP EXPENDITURES - 1959-1973

DIPP expenditures for the first 19 years of its operation were $601 million. The breakdown is shown in Exhibit 1, opposite.

For comparative purposes, the DIPP expenditures were adjusted to constant dollars, taking 1971=100 with the results plotted in Exhibit 2, opposite. This graph shows that funding was relatively constant between 1969/70 and 1973/4, declining substantially thereafter. Adjusting for deflation and maintaining the real value at the 1969/70 - 1973/4 levels, would give a present day funding around $80 million.

The 1978/9 actual funding was $52.2 million: 1979/80 funding exceeded $60 million; requests for 1980/1 funding approach the $80 million equivalent mentioned in the preceding paragraph.

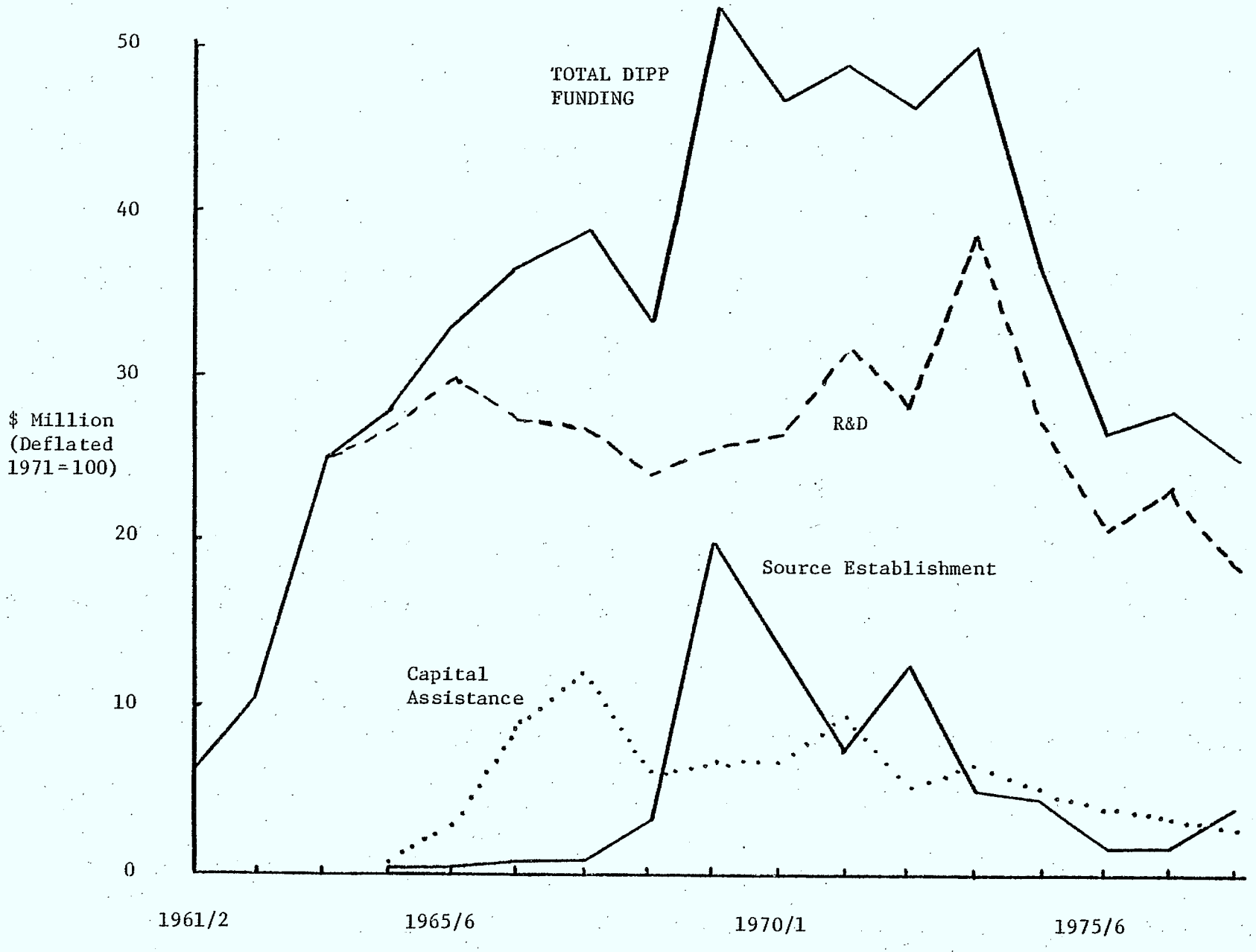

EXHIBIT 2

DIPP EXPENDITURES BY PROGRAM COMPONENT BY YEAR

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IV - DISTRIBUTIONAL CHARACTERISTICS

VARIATIONS BETWEEN DIPP COMPONENTS OVER TIME

During its first ten years, DIPP delivered 300 projects (value approximately $177 million) through dedicated program delivery units headed by SX-1 authority levels (in the principal ISB's), with comfortable staffing levels. The DIPP Committee comprised some few ADMs with continuity of performance, who provided program management and project approval.

The second ten years saw a doubling in numbers of projects, (value $476 million), the elimination of dedicated ISB program delivery units, a softening of the authority levels, and a dwindling of program delivery staff by 25%. The DIPP Committee doubled in size, the authority levels of attendees diminished, continuity became erratic, and the level of exercise of authority and incisiveness reduced the function to a project approval mechanism.

The components of DIPP also changed. There was a relatively steady R&D base, but wide fluctuations in Capital Assistance and Source Establishment components: if business was good, CA was up with SE down; the reverse occurred in poor business years. The fluctuations made it difficult to manage the balance between the separate loan and contribution votes. This topic is further discussed in Annex VII D.

The basic characteristic of DIPP, from a funding viewpoint, is stated to be its major sensitivity to the North American business cycle for advanced technology products. Highs in this business cycle put funding pressures on

EXHIBIT 3A: DIPP EXPENDITURES BY PROGRAM COMPONENT 1969-1979

Program Component	Projects #	(%)	Expenditures $ million	(%)	Average Value $ thousand
Research & Development	199	(33)	292.8	(69)	1,471
Capital Assistance	291	(48)	52.0	(12)	179
Source Establishment	114	(19)	79.5	(19)	697
TOTALS	604	(100)	424.3	(100)	

Source: FSB GC-154 File

EXHIBIT 3B: DIPP EXPENDITURES BY ISB 1969-1979

		PROGRAM COMPONENT						
		Capital Assistance		Source Establishment		R&D		TOTALS #&$000
USER BRANCH			(%)		(%)		(%)	
Chemicals	# Projects	8	(73)	3	(27)	-	(0)	11
	$ 000	878	(10)	7,692	(90)	-	(0)	8,570
Electrical & Electronics	# Projects	74	(30)	42	(17)	131	(53)	247
	$ 000	12,620	(11)	8,251	(7)	96,104	(82)	116,975
Machinery	# Projects	33	(81)	5	(12)	3	(7)	41
	$ 000	4,438	(56)	241	(3)	3,194	(41)	7,873
Resource Industries	# Projects	9	64	4	29	1	7	4
	$ 000	1,248	(55)	386	(17)	627	(28)	2,261
Transportation Industries**	# Projects	163	(57)	59	(21)	62	(22)	284
	$ 000	32,552	(11)	62,780	(22)	190,978	(67)	286,310
Tex. & Consum. Products	# Projects	4	(100)	-	(0)	-	(0)	4
	$ 000	312	(100)	-	(0)	-	(0)	312
Indeterminate*	# Projects	-	(0)	1	(50)	1	(50)	2
	$ 000	-	(0)	109	(10)	1,029	(90)	1,138
Defence Programs	# Projects	-	(0)	-	(0)	1	(100)	1
	$ 000	-	(0)	-	(0)	1	(100)	829
TOTALS	# Projects	291	(48)	114	(19)	199	(33)	604
	$ 000	52,049	(12)	79,459	(19)	292,762	(69)	424,270

SOURCE: FSB File GC-154

* This entry is probably a computer coding error. The companies are Valleyfield Chemicals (1-858) and Space Research Co., Quebec (1-888)

** This is primarily, but not exclusively, aerospace.

DIPP, and vice versa. And these business cycles are not always in phase with the general state of the economy.

DIPP EXPENDITURES BY PROGRAM COMPONENT

Due to the problems associated with collecting data on old projects, the evaluation of DIPP concentrates on the 1969-79 period. The number of projects in each program component for this 10-year period is summarised in Exhibit 3A, opposite.

R&D

It will be noted that while R&D accounts for only 1 in 3 projects, it accounts for almost 70% of all funding. Some distortion exists in the average R&D project size due to the impact of large projects: the average size of R&D projects, with large projects removed, is closer to half the value shown.

Capital Assistance

CA projects account for almost every second project, with an average value of less than $200,000. It should be noted that Capital Assistance projects have a traditional "Matching Investment" requirement; that is, the company is expected to upgrade its facility by an amount of funds equal to the contribution and loan. This does not have to be in the form of extra advanced capital equipment, though it may be. Factory extensions, renovations, new machinery, and general modernisation at the company's expense are also allowable.

The relative generosity of this component, which has been commented on because of the 50% contribution and 50% interest free repayable loan, is reduced by the matching investment requirement.

Source Establishment

SE projects account for 1 in 5 projects. Such contributions are only payable if the company wins the contract it bids on. Winning the contract is generally, but not always, a measure of success. Some end user contracts are performance dependent, i.e., ITC may fund the Canadian bidder for the full contract, but if the Canadian company fails to perform on the trial quantities, the contract may be re-directed. Our examination did not detect any such non-performance by Canadian companies.

In other instances it is possible to win a contract for a major foreign project that itself collapses. This occurred in the Canadair contract for the French Government sponsored "Mercure" aircraft. Canadair won the contract. $11.5 million of Crown funds were invested, based on so-called guaranteed minimums by the French contractor. The "Mercure" was a disastrous commercial flop, and the "guaranteed minimums" were neither achieved nor honoured by the French. Other pitfalls are described later.

Some distortion in the average contract value is caused by McDonnell Douglas, with a major funding program. (It should be noted that this latest contract is a repayable contribution, because of the good economic return.) The average SE contract, however, is closer to $500,000.

DIPP EXPENDITURES BY INDUSTRY SECTOR BRANCH

The FSB GC-154 computer file was also examined for distribution by Industry Sector Branch program users. The relevant data are shown in Exhibit 3B.

A summary of the preceding table is given in the table below:

PRINCIPAL ISB USERS OF DIPP, 1969-1979

ISB	# Projects	(%)	$ million	(%)
Chemicals	11	(2)	8.6	(2)
Electrical & Electronics	247	(41)	117.0	(28)
Transportation Industries	284	(48)	286.3	(68)
Resource Industries	14	(2)	2.3	(-)
Machinery	41	(7)	7.9	(2)
TOTALS	597	(100)	422.1	(100)

COMPANY OWNERSHIP

To 1970/1, the universe of 153 companies, which had generated $2.7 billion in sales, were 51% Canadian owned and 49% foreign owned. However, all of the largest companies (5) and two-thirds of the medium-sized companies (12) were foreign owned: only in the group comprising the smaller companies (less than 200 employees) did Canadian owned enterprises exceed foreign subsidiaries in number.

By 1975/6, the universe had increased to 206 companies generating $5.7 billion sales, and there had been a slight shift in favour of Canadian ownership to 56%, with foreign ownership declining to 44%. Since the corporations were not specified by name, no direct comparison could be made, but examples of the change might include the transfer to Canadian ownership of Canadair and de Havilland as well as an increase in the number of smaller companies.

EXHIBIT 5

DISTRIBUTIONAL CHARACTERISTICS OF THE SAMPLE

		Companies ($ & %)	
		Mini	Major
Foreign		37,175,856 (80.0)	130,433,756 (48.5)
Canadian		9,281,507 (20.0)	138,351,859 (51.5)
Size:	Large (1000)	19,129,370 (41.2)	268,785,615 (100.0)
	Medium (500-1000)	12,934,167 (27.8)	- -
	Small (500)	14,393,826 (31.0	- -
Type:	Aerospace	3,424,893 (7.4)	227,801,021 (84.8)
	E&E	39,494,390 (85.0)	40,984,594 (15.2)
	Others	3,538,080 (7.6)	
Location:	Ontario	33,792,604 (72.7)	143,785,530 (53.5)
	Quebec	10,224,016 (22.0)	124,900,085 (46.5)
	Maritimes	1,891,141 (4.1)	- -
	West	549,602 (1.2)	-

EXHIBIT 4

CHARACTERISTICS OF MINI AND MAJOR CASE STUDY COMPANIES

		Companies (#)	
		Mini	Major
Foreign		11	3
Canadian		12	3
Size:	Large (1000)	2	6
	Medium (500-1000)	5	0
	Small (500)	16	0
Type:	Aerospace	2*	4
	E&E	13	2
	Others	9	0
Location:	Ontario	13	2
	Quebec	5	4
	Maritimes	2	0
	West	3	0

* One company is in both the E&E and Aerospace sectors.

CHARACTERISTICS OF MINI AND MAJOR CASE STUDY COMPANIES

As noted elsewhere, the evaluation of DIPP is largely based on an in-depth study of a sample of firms that have received DIPP funding. Information on other distributional characteristics of DIPP companies is available from this sample.

As shown in Exhibit 4, opposite, the sample of mini case studies is made up of 23 firms (17 R&D firms and 6 CA/SE firms). The 6 major case studies are the largest users of DIPP since the program began in 1959.*

The previous section reported that DIPP has funded about the same number of foreign-owned and Canadian-owned firms. Examining the foreign-Canadian split in the sample shows that the same ownership proportions exist. In terms of the amount of DIPP funding, however, the sample reveals that foreign-owned firms in the mini case studies have received the bulk of the funding, shown in Exhibit 5, opposite.

In terms of company size (number of employees), most of the mini case study firms are small, although the largest companies received 41% of the DIPP funding.

Not surprisingly, most of the sample firms are in the E&E sector, as more firms in the E&E sector than in any other have received DIPP R&D grants, as shown.

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* One major case study, Microsystems Ltd., is not included here as the bulk of its funding was received before 1970.

EXHIBIT 6

ACCUMULATED DIPP SALES (ACTUAL SALES REPORTED), $ MILLION

Fiscal Year	Projects Completed	Crown Expenditure	Reported Sales	Ratio Sales÷Expenditures
1973/4	344	332.2	4,386	13.2
1974/5	419	362.6	5,672	15.6
1975/6*	396	363.0	5,673	15.6
1976/7*	423	398.0	4,620	11.6
1977/8*	469	442.0	5,615	12.7

Notes: - Sales are accumulated from 1959 for completed projects
- Crown Expenditures relate to completed projects
- 1973/4 and 1974/5 are company reported data
* 1975/6, 1976/7, 1977/8 are estimated by DIPP Office.

Finally, over 90% of DIPP funding has been allocated to companies in the manufacturing heartland of Canada - Ontario and Quebec.

V - THE AGGREGATE PERFORMANCE OF DIPP

DIPP PROJECTS SALES RESULTS*

The information contained in Exhibit 6, opposite, is developed from data presented in DIPP Annual Reports, by the DIPP Office. They include defence, civil and joint projects.

It will be seen that the latest three fiscal year figures are discontinuous from the first two: this results from the breakdown of the company reporting of data through the ISB's to the DIPP Office. We have been unable to discover the reason for the incongruity in reported sales data. It would seem that the same data was used for two consecutive years. The decrease shown for 1976/7 may represent a typographical error. The net effect is that three years after termination of company sales reporting in 1974/5, the 1977/78 "estimated sales" were still below the 1974/5 benchmark.

An attempt to verify these sales by other estimates, namely the retrieval of sales data for excess profits calculations by Financial Services Branch, produced such wide variances that the FSB estimates were equally suspect. All we can say is that the 1977/8 figures above are probably conservative.

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* See the Program Delivery Annex for a discussion of the reliability of these data.

The last column in Exhibit 6 shows the ratio of company product sales to Crown investment. This ratio is specified in the directive as a criterion for examining DIPP projects for economic benefit. The directive specifies export markets for defence and related civil products and requires that the ratio be within a range of 10-20 times the Crown investment. The Canadian content is the determinant: for a content less than 50%, the ratio will be 20:1 or more; for a content greater than 50%, the ratio will be 10:1 or more.

Examination of the files indicated that this requirement was generally taken into account. However, in view of the sales forecasts used, and the historic quality of the level of market scrutiny, some of the forecasts were probably over-optimistic. In general, ITC market assessments were lower than the company's by some 30%. Because of the breakdown in the retrieval of company sales results systems, we will had difficulty in comparing actual project sales against forecasts for which the project was approved. In a few cases, mainly in simple Source Establishment projects where the end contract value could be accurately determined (such as by a phone call to the US purchaser), the Crown investment was reduced by the Market Advisor to ensure that the directive ratios of 10:1 or 20:1 were maintained.

We have no evidence that Crown investments were so adjusted in all cases, or even that it was possible to do it in all cases, sales forecasts being open to argument. We note that it did occur.

EXHIBIT 7

JOINT PROJECTS: OVERALL DDSA INVESTMENT VS. RESULTS, $ MILLION

US Military Service	Projects			Investment, Sales Completed Projects $ million	
	Total	Progress	Completed	Crown Investment	Sales ISB
US Airforce	30	8	22	10.8	31.9
US Navy	17	4	13	20.4	385.2
US Army	24	1	23	41.4	521.5
Totals	71	13	58	72.6	938.6
Ratio Sales/Investment					12.9

JOINT PROJECT SALES

Joint project sales, as a subset of the data discussed above, were examined. The data relate to the Canada/USA Defence Development Sharing Agreement (DDSA). To 1979, 71 such projects had been initiated and 58 completed, shown in Exhibit 7, opposite.

It will be noted that the ratio of US defence project sales to expenditure, at 12.9, is less than the Exhibit 7 ratio of 15.6 for 1974/5, and almost the same as the 1977/8 ratio of 12.7. The DIPP Office, the Defence Programs Branch, and ISB's point out that considerations other than pure economic profit are involved in joint projects, such as having defence goals emphasized more strongly.

Of the completed 58 Canada/USA projects, no less than 18 had some degree of payback. Three projects were clearly successful: the CMC GRC-103 radio, at over $170 million; the Pratt and Whitney Helicopter Twinpak at $355 million; and the de Havilland Buffalo aircraft (though not to the US market) at $333 million.

Of the non-US joint projects, which are not included in the above, the major successful project is the Canadair CL-89 drone. Two other drone projects are still in progress, the CL-227 and the CL-289 for which no sales have been yet recorded.

RATIO OF CIVIL TO DEFENCE SALES

Using Canadian company sales as the measure, DIPP Office data indicate that in the first decade of DIPP, to 1970/1, civil sales accounted for 40% and defence sales for 60%. This is interesting because it establishes that, while DIPP was defence oriented until 1968, substantial civil exports had been occurring. Five years later, to 1975/6, there had been only a minor change. Civil sales accounted for 42% and defence sales for 58%. In this period, gross accumulated sales increased from $2.7 billion (1970/1) to $5.7 billion (1975/6).

This raises the question of how defence/civil sales are defined and relates back to the definition of the Canadian defence industry.

COMPANY SIZE RELATED TO CROWN INVESTMENT AND SALES REVENUE

Overall parameters are described in the Exhibit 8, opposite.

The exhibit indicates that the larger the company, the more efficient it is as a multiplier of Crown input funding relative to sales. The reasons for this efficiency may be related to size, multinational relationships, experience, greater marketing and management capability, and other factors.

VI - PROGRAM AND PROJECT DELIVERY CHARACTERISTICS

Statistics for some selected characteristics of delivery are shown in Exhibit 9, opposite, for the 58 R&D projects which were included in the ISB

EXHIBIT 8

COMPANY SIZE VS. CROWN EXPENDITURES AND PRODUCT SALES TO MARCH 31, 1975

Employees	No.	(%)	Crown Expenditure $	(%)	SALES $	(%)	RATIO SALES divided by Expenditure
2000-5000	6	(3)	192 M	(53)	3,800 M	(67)	19.8
200-2000	25	(12)	125 M	(34)	1,460 M	(25)	11.6
0-200	175	(85)	45 M	(13)	410 M	(8)	9.1
	206	(100)	362 M	(100)	5,670 M	(100)	15.6

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EXHIBIT 9

SELECTED CHARACTERISTICS OF PROGRAM DELIVERY FOR R&D PROJECTS

Time Period	Type of Project	No. of Projects	Total Funds Authorized 000'$	Ave. Funds Authorized Per Project 000'$	Sharing Ratio Crown/Other		Nature of Project[1]		Ave. contract extension[2]			Time from DIPP Committee recommendation to date of Contract agreement[3]	
					No. of Projects	Ratio	Original	Follow-on	projects completed on time	projects extended number	projects extended ave. no. of days	No. of Projects	Ave. No. of days
1974-79	defence	7	3,383	483	6	50/50	1	6	2	5	354	6	339
					1	80/20							
	joint	7	5,557	794	5	50/50	4	3	3	1	513	4	168
					1	55/45							
					1	75/25							
	defence-related	17	29,813	1,754	15	50/50	7	10	5	5	255	15	186
					2	90/10							
Sub-totals		31	38,753	1,250			12	19	10	10	320	25	220
1969-73	defence	9	17,766	1,974	9	50/50	5	4	2	4	532	7	230
	joint	5	11,677	2,335	3	50/50	3	2	1	1	91	1	507
					1	40/60							
					1	45/55							
	defence-related	13	11,949	919	10	50/50	10	3	1	8	511	8	314
					1	75/25							
					2	55/45							
Sub-totals		27	41,392	1,533			18	9	4	13	485	16	289
1969-79 totals		58	80,145	1,382			30	28	14	23	413	41	247

(1) An "original" project was one in which the development activity was in an area in which the company was not previously involved whereas a "follow-on" project represented a continuation of or more advanced stage of development activity previously engaged in.

(2) For the 21 projects not accounted for, either the required data on contract completion time was not available from the file documents or the contract conditions had changed to the extent that the original completion date was no longer relevant.

(3) For the 17 projects not accounted for, the required data on the relevant dates was missing from the file documents.

file review. The projects were divided into three categories, namely, defence, defence-related and joint. The defence projects were those for which the prospective market for the expected output was principally defence agencies. For defence-related projects, the expected market was primarily of a civilian nature, such as commercial airlines. The joint projects were those which had joint funding arrangements in which a foreign agency such as U.S. DOD shared in the total cost of the project. The projects were also grouped into two time periods, those which were approved during the 1969-73 period, and those which received approval in the 1974-79 period.

DISTRIBUTION OF FUNDS

Based on the above groupings of the projects, the statistics indicate that in the earlier period, the total funds authorized were split fairly evenly between the three types of projects, but with the defence projects accounting for the largest share. There were two particularly large projects in this time period: the CAE Electronics TAGS joint project for $10.2 million and the Canadian Marconi avionics diversification defence project for $13.3 million. In the more recent five-year period, three-quarters of the authorized funds were for defence-related projects. Two Pratt and Whitney projects were primarily responsible for this particular allocation of funds.

The average funds authorized per project for the various groups of projects were influenced substantially by the above four large projects. The result was average funds of $2.0 million and $2.3 million, respectively, for the two groups of defence and joint projects during the 1969-73 period. The average for defence-related projects in the 1974-79 period was $1.8 million.

By far the most common sharing ratio for total project cost was a ratio of 50:50 or, in other words, equal sharing of total project costs. Forty-eight of the total sample of R&D projects were in this category. At the other extreme, two Canadian Marconi aerosat projects received Crown funding support of 90 percent and a Hermes sonobuoy project received 80 percent support. Generally, the higher levels of Crown support were given for projects with high risk and/or with a longer payback period.

NATURE OF PROJECT

An attempt was made to categorize the projects as original and follow-on. A follow-on project was one in which the development activity was a continuation or more advanced stage of activity which had been previously undertaken. The development activity of an original project was more discrete and judged not to be a direct continuation of earlier work. The total sample of R&D projects split almost evenly between these two categories. The "original" type of project predominated during the 1969-73 period; whereas in the succeeding period, the follow-on type of project was more common.

During the examination of the file material for the R&D projects, it was noted that a considerable number of the projects were not completed within the original time schedule. In these cases, the original contract agreement had to be amended to extend the completion date. The principal reason for the extensions was that the various technical tasks did not get completed on schedule. In a few instances the "slowdown" was designed to lessen the burden on the company's financial resources.

CONTRACT EXTENSION

A tabulation was done to determine the frequency of the contract extensions. A total of 37 projects were involved, and, of these, 14 projects or 38 percent were completed within the originally scheduled time frame. For the remaining 23 projects, the average extension time was 413 days, or somewhat more than one year. The majority of the contracts completed on time were projects which were approved during the 1974-79 period. For the projects which were extended, the average extension time was 320 days for the projects approved between 1974 and 1979 compared to 485 days for projects undertaken during the 1969-73 period. These latter statistics, although based on a limited number of observations, suggest that there has been some improvement in more recent years in completing projects on schedule.

PROCESSING TIME IMPROVEMENT

Annex VIIA of the DIPP Evaluation Study examines the length of time required to process the project applications through the various approval stages. Some additional data are contained in Exhibit 9, namely, the processing time required from the date of DIPP Committee recommendation to date of contract agreement by type of R&D project. The figures suggest that there has been some gain in the efficiency of this operation over the past decade although the number of observations are limited. For the 1969-73 period, the average processing time for 16 projects was 289 days. This compares with a time interval of 220 days for 25 projects during the 1974-79 period. It was not possible from the file material to determine the reasons for the improved processing time, but the statistics in Exhibit 9 indicate that the improvement occurred for defence-related and joint projects rather than for defence projects.

ECONOMIC AND RELATED BENEFITS:

APPENDIX D TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

ECONOMIC AND RELATED BENEFITS:

APPENDIX D TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

TABLE OF CONTENTS

I - INTRODUCTION

This section discusses the approach used to calculate the economic benefits of the DIP Program. In addition, it discusses effects of the program on issues which are sometimes associated with those benefits; namely, the effect of DIPP on offset arrangements, on the locating of plants in Canada, and on high technology employment.

II - ECONOMIC APPRAISAL

One of the major objectives of the DIPP is to generate economic benefits to Canada. The economic evaluation of DIPP projects requires an examination of the impact of these investment expenditures on the economic well being of the country as a whole.

When the government decides to intervene in the economy by means of DIPP grants, it must not only be concerned with the rate of return received by the private investors, but it must also determine the economic efficiency with which Canada's scarce resources are being utilized. An efficiency criterion must be used to measure the economic return of funded projects against the return which the resources utilized would have produced if left to their next best alternative use.

BASIC METHOD

To establish whether or not DIPP investments are economically beneficial to Canada, the total economic return for each project was assessed against a

standard defined as the total economic return that these resources would generate if they were invested in alternative projects instead. This standard requires that, in order to be worthwhile, the net present value of the project must be positive when a social rate of discount of 10 percent is applied to the cash flows of the project as adjusted to reflect economic externalities. The social discount rate of 10 percent was derived from the observed economic rates of return produced by the various sectors of the Canadian economy. A detailed methodological outline of the techniques used to evaluate each individual case study, including the routine for economic adjustments, is contained in the CAE major case study in Annex IA, Major Case Studies Annex. Each economic adjustment is discussed in general terms and in relation to the specific circumstances of the project.

In the economic evaluation of each of the 7 major case studies, the analysis was carried out and reported in constant dollars of the initial year of the project. The results were discounted to a net present value as at the initiation date of the individual project.

Because our study sought to evaluate the overall results of the program rather than the results of each individual project, it was necessary to aggregate the results of all projects analyzed. We therefore converted all net present values to 1969 dollars and summed them. The result is a picture of the overall economic impact of the program on Canada throughout the program life. An alternative approach would have been to discount all results to the beginning of the program in 1959. This, however, would have accorded undue weight to the early projects as opposed to the later projects and would have implied that the whole program should be viewed as a single investment

decision at its beginning. We did not feel that this would be appropriate and so have adopted the device of summing the net present values through all of the years. The results are discussed in Section II of the Covering Report.

To aggregate the mini cases, the values for the sample were factored up. Since this was a randomly chosen sample, the factor was based on the proportion of the number of cases to the total number of DIPP non-Major projects.

RETURN ON INVESTMENT (ROI)

Another measure, besides NPV, which can be applied to economic projects is the ROI rate. This rate was also calculated for each project and for the program as a whole.

In order to calculate the ROI for each project, the standard technique was applied of adjusting the discount rate until the NPV at the start of the project was zero.

For the program as a whole, an estimation technique was used which treated the program as a single project extending over the average life of the individual projects (seven years); and in which the Crown and private investments were spread over the first three years and the returns over the last three. Using the summed NPVs, discussed in the preceding section, as the NPV for the program as a whole, the corresponding returns were calculated with the program expenditures kept fixed. The discount (ROI) rate which would cause the NPV to be zero was then calculated.

SOCIAL VS. PRIVATE ROI

All economic benefits were calculated from a societal point of view, as described in the CAE Major Case Study (Annex IA). As a matter of interest, however, an estimate was made as to the private returns. Since society realizes benefits beyond the private ones, e.g., taxes and employment, the social rate is higher. In the case of the DIP Program, the social ROI is estimated to be 3%-4% greater than the rate of private return which DIPP projects would have produced for private investors.

VALUES FOR THE CAPITAL ASSISTANCE (CA) AND SOURCE ESTABLISHMENT (SE) PROJECTS

The evidence concerning the economic benefits derived from the CA projects was somewhat contradictory. The case study ROI average was 7%. The sample here, however, was small and was strongly affected negatively by one case. The data from the User Survey, which provided a much larger information base, established that the sales from CA projects were higher than sales from R&D projects. Sales, of course, are not a direct measure of economic benefits. This figure does, nevertheless, correlate with the economic benefits. Moreover, on incrementality was found to be higher for CA projects than for R&D projects.

An associated topic is the calculation of ROI when the benefits, in the form of price reductions, are spread throughout the firm. In this case the DIPP funds were treated as if they had been made available generally to the firm, and the return was calculated on that basis, i.e., what return the firm was realizing.

A review of all of the evidence, then, led us to judge the ROI for CA projects could be taken to be the 10% norm.

In the SE projects category, the McDonnell Douglas case accounted for about half of the total funds disbursed. (McDonnell Douglas was studied independently as one of the Major Cases. It appears in Annex IE). The remaining SE cases were too few to permit a statistically valid examination.

A qualitative review has led us to the opinion that, due primarily to the requirement that a contract be secured before the grant is given, the return on SE projects is at least as high as on CA projects.

III - OFFSETS

Although not a direct goal of DIPP, it has become clear that there is at least some cross-impact between the Program and the Offset arrangements worked out in connection with certain large defence contracts.

Firms were directly questioned about this relationship. We found that the DIPP "family" of companies were certainly taken up in the offsets; the following are the percentages of firms involved:

Major Cases	67%
Non-Major R&D	36%
CA	20%

The firms were asked whether or not DIPP funds supported (assisted) their capability to participate in these arrangements. They responded affirmatively in the following proportions of the firms involved and of all firms:

	FIRMS INVOLVED IN OFFSETS	ALL FIRMS
	%	%
Major Cases	50	34
Non-Major R&D	20	7
CA	50	10

Note that the study was not able to determine the degree to which DIPP contributed to this capability. Nevertheless, it is clear that DIPP has had a positive impact on the Offset arrangements. As much as possible, this effect was allowed for in the economic benefits assessments for the CA cases and in the "Spin-offs" study.

The firms did not report any reverse impact; that is, that the Offset arrangements made them better prepared for a DIPP project.

The question has occasionally been raised as to the extent of "double funding" through DIPP and the Offset arrangements. The Offset arrangements are not, however, a funding program; participation in them is competitively achieved. We do not believe, therefore, that double participation means double support.

LOCATION IN CANADA

Firms were queried on the effect which the existence of DIPP has had on their being in Canada. They reported that they were in Canada because of DIPP in the following proportions:

Major Cases	33%
Non-Major R&D	21%
CA	0%

This factor has not been allowed for in the assessment of economic benefits, in good part because there is no evidence that the current DIPP would have a relative advantage in this regard over other program designs or other programs.

HIGH TECHNOLOGY EMPLOYMENT

High technology employment, in itself and economic benefits aside, has not been examined in detail in this study. Two points of interest were uncovered, however:

- The proportion of scientists and engineers in the workforce of those companies studied in the Major and Mini Cases was 11%;
- The percentage of scientists and engineers in the overall work force in Canada is about one-third of that in the U.S.

DEFENCE RATIONALE FOR DIPP:

APPENDIX E TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

DEFENCE RATIONALE FOR DIPP:

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TABLE OF CONTENTS

I - INTRODUCTION

The economic orientation of the overall evaluation report is consistent with the aims formally stated for the Program right from its inception.* Nevertheless, it is true also that the DIP Program has long had some association with Canadian defence objectives. Consequently, we deemed it necessary to make some effort to study and provide a commentary on the broad defence rationale.

This rationale has been seen by various groups as having one or more of the following components:

- To maintain an industrial base for the supply of defence equipment in times of emergencies;
- To maintain in Canada a defence industrial capacity to service and maintain advanced DND equipment;
- To minimize the cost of acquisition to DND of equipment and supplies.

In discussing these rationales, the question of the contribution which DIPP has made in the eyes of the experts and of the firms is addressed first. How DIPP fits into the reality of Canadian defence policy and planning is then considered.

II - ASSESSMENT OF DIPP CONTRIBUTION TO DEFENCE

Study of the companies, through interviews and questionnaires, leads to the following conclusions regarding the defence involvement of the DIPP firms:

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* A compilation of these statements, with dates, is given in the last section of this Appendix, as an Addendum.

- DIPP companies are clearly heavily involved in defence; the percentage of their sales which go, directly or indirectly, to defence agencies is

  Major Case firms - 28%

  Mini Case R&D firms - 56%

  CA/SE firms - 58%

- For the non-major firms this proportion seems likely to stay roughly the same in the foreseeable future; the major firms, however, see some decline in defence sales as a percentage of total sales.

- In view of the recent limited DND equipment acquisition budgets, it is not surprising that, while most of the majors have made some sales to the CF, 79% of R&D and 73% of the CA/SE firms have not concluded such sales. Currently, however, sales to the Canadian Forces average averages 23% of the sales from the CA/SE, 11% from R&D and 0% from the Major companies.

- As to the maintenance of their own equipment purchased by the CF, the company responses indicated that both R&D and CA/SE firms on the average were involved to only a small extent (2.2 and 1.8 on a 5-point scale), while the majors were "moderately" involved (2.7 on this scale). We found that 64% of the R&D firms and 50% of the CA/SE firms have not been involved at all in such maintenance over the past three years, which is consistent with the other responses from the firm.

- All groups of firms were involved only to a very small extent in the maintenance for the CF of other firms' equipment.

The experts were asked in their questionnaire to rate the average contribution of a DIPP project to Canadian and Western defence. Then responses averaged 3.8 and 3.9 respectively on a 5-point scale.

DND officials assessed the R&D DIPP firms as having a moderate-to-high capability (6 on a 10-point scale) to support DND's potential maintenance needs.

Clearly, then, the DIPP firms are:

- Involved in defence products;
- Have the potential, through their products, to contribute materially to defence capability; and
- Are involved to only a very limited degree in the maintenance of CF equipment.

III - RELATIONSHIP BETWEEN DIPP AND CANADIAN DEFENCE POLICY AND PLANNING

Unfortunately - from the point of view of establishing the thesis that DIPP has a defence rationale - the companies and the experts were speaking from a perspective which is outside the framework provided by current Canadian defence policy and planning.

If the three elements of the possible defence rationale, listed in the Introduction, are considered from that policy and planning perspective, the following has emerged from what is admittedly a non-exhaustive study of the topic.

As far as we could determine, the first component, which is essentially a mobilization base concept, has never been (even in the '60s) a formally stated objective of the DIP Program. No formal reference of any sort has been found which states the requirement in the rather bold wording given above. On the other hand, a good many of the communications concerning DIPP carry some flavour of the mobilization base approach; phrases such as "a strategic base of industrial capacity and preparedness" are often used. Accordingly, it seems worthwhile to analyze the validity of this imputed objective and to establish whether it has been taken into account in DND policy.

Canadian Defence Policy

For some time - certainly over the past twenty years - Canadian defence policy has very largely been based on the "forces-in-being approach". The policy is comprised of the following elements:

- The individual tasks required of DND in its continuing responsibilities - tasks such as peacekeeping, or search and rescue - can best be performed by the regular forces on hand ("in-being");
- The major aspect of these continuing responsibilities, namely deterrence, is also best served by having forces in being: forces which could assure that the Eastern Bloc could not casually move into geographical areas critical to Western interests without becoming involved in military encounters which would raise the serious possibility of a nuclear war.
- The major role of reserve forces is to form personnel pools which could very quickly bring the regular formations and units up to a wartime footing.

The logistics (and materiel) base within DND has been developed to support this concept.

Validity of First Component of the Defence Rationale

In none of these elements then, is there a requirement for an industrial mobilization base.*

It is quite possible that the evolution of the strategic defence concerns may bring about a rethinking of Canadian defence policy. But the critical point from a DIPP evaluation perspective is that:

- The mobilization base concept is not consistent with recent or current Canadian defence policy;
- Consequently, no formal requirement for the development of such a mobilization base policy has ever been given to ITC, the department responsible for this aspect of emergency planning.**

It may be that the foregoing will strike some readers as an attack on a "straw man". It has been felt necessary, however, to analyze the status of this imputed objective because it is still subscribed to by some, and consequently continues to affect the thinking about DIPP.

Validity of Second and Third Components

Regarding the second and third components of a possible defence rationale, (stated in the introduction), certain observations could be made:

1) In the past, both of these components have been mentioned as sub-goals of the Program. Neither has been mentioned in the current directive. Moreover, so far as can be determined, both of these components are fundamentally economic.

* It could be argued that even forces-in-being require some degree of industrial base to replenish their immediate stocks but current statements of defence requirements do not reflect such a need.

** Such a (full) statement of requirements would be critically important to support the mobilization base concept since this concept requires that the planning be complete; that is, it must show how all the parts of an item can be produced or procured; 80% of a gun is not a gun.

These two components of the defence rationale have been justified as contributing primarily to economic rather than defence benefits. Those who have subscribed to them have been concerned primarily with minimizing costs.

Two additional considerations have bolstered these elements of the defence rationale: convenience and fast response in peace-time conditions. (Maintenance under crisis conditions will be discussed subsequently.) Clearly these are valid considerations. Valuable time and money can be lost due to delays in repair and overhaul. There are very real difficulties in making logistic arrangements with foreign firms who may not be highly motivated to accommodate peculiarly Canadian problems.

But these characteristics can be attained in other ways than through the maintenance of an industrial base to service equipment for the Canadian forces. The choice of the means depends on their cost vs. the inconvenience and loss of efficiency. And, since this then becomes a DND objective, it is the defence decision-maker who has the responsibility for the results. He should decide on the worth of a given level of support and the associated expenditure which he is willing to make; in other words, the decision should be a truly responsible one.

DIPP and Defence R&D

An additional relationship might exist between DIPP and defence objectives through support of DND's R&D goals. However, while ITC has

a responsibility for support of industrial mobilization plans, it has no such responsibility towards DND's R&D activities. Until the government assigns such a responsibility, this would not be a valid link between this ITC program and the Defence program.

In the final analysis, then, just as DND quite justifiably takes the position that its funds should not be spent on the procurement of high cost Canadian made equipment to support industrial objectives so, logically, ITC should take the position that it is DND funds (rather than DIPP funds) which should support the DND objective.

2) There has been no formal official statement to direct DIPP as to precisely which firms should be supported from this point of view. (It must be noted that there have been communications from DND at a senior, but not ministerial, level to indicate those firms which DND views as "important").

3) Current crisis planning concepts do not include requirements for maintenance in crisis conditions (e.g., the industrial facilities which would be required to effect such maintenance).

4) To tie these points together, if DIPP were required to support defence maintenance objectives, it would have to have a basis for making trade-offs between various (and generally competing) aims. Currently, defence policy, as represented by the guidance which DIPP has received, does not require such trade-offs.

IV - RELATED CONSIDERATIONS

Certain additional issues related to the defence rationale should be discussed.

Defence Benefits to Allies

The view could be held that maintaining a defence industrial capacity to service and maintain advanced military equipment in Canada, even though not directly related to Canadian defence needs, contributes to the defence capability of the West. However, if that capacity were not developed in Canada, it would be developed elsewhere within the Western community. Consequently, the Western community as a whole does not gain significant defence benefits. There are, of course, benefits to Canada from making this contribution to overall Western defence, but they are economic benefits - which are explicitly being evaluated.

Balance between Defence Exports and Imports

A point which arises from the origins of DIPP is the attitude that defence exports to the U.S. should balance imports. This perspective is understandable for two reasons:

- It is a politically sensitive topic since the Canadian public is perceived as believing that money spent on defence should be spent in Canada, or at least offset to achieve a balance;

- As with the automobile industry (the only other area in which balance is a stated goal), there is a judgement that Canada has sufficient leverage

and/or sympathy to attain a greater export sale level than normal economic considerations would indicate.

But it also could be argued that it does not necessarily require a program such as DIPP to exercise these levers; a balance in defence trade could conceivably be achieved through negotiations and other operational tactics.

Beyond these points, however, there are two factors which should dominate the consideration of balancing defence imports and exports:

- the benefits gained from defence export sales must still be judged by the economic performance of DIPP (as discussed elsewhere in this report);

- economic considerations are the prime considerations.

Participation in the Industrial Preparedness Program

Using the CCC as its agent, the Canadian government has established a relationship with the U.S. DOD Industrial Preparedness Program. This relationship allows Canadian firms to become recognized participants in this program on an equal footing with U.S. firms and, thereby, to bid on some proposals from a favoured position. The absence of a Canadian industrial mobilization plan, however, means that this activity does not directly support Canadian defence. Moreover, all indications are that Canadian involvement is intended to meet an economic goal: the increases in export sales. It is also reasonably clear that the U.S. defence procurement in an emergency would not be critically dependent on any one Canadian firm.

Smaller Calibre Ammunition Industry

The smaller calibre ammunition industry may well be a special case because its products are needed in conditions of both war and peace. There is a continuing requirement of some magnitude, even in peacetime, for such supplies (just as there is for food and petrol). Moreover, smaller calibre ammunition could be required by Canada for peculiarly Canadian military needs (e.g., peacekeeping) so that reliance on foreign supplies could be awkward. Accordingly, it is probably only prudent that this industry be treated as a special case in whichever way seems most appropriate to the interdepartmental group now examining its future.

V - CONCLUSION

There has been an understood defence objective for the DIP Program and DIPP has made noticeable contributions to this objective. Over time, however, developments within defence policy have tended to lessen the fit between this (defence industrial base) objective and overall defence policy. From the aspect of staff duties, therefore, the defence objective should be clarified. Beyond this, however, and from the stand-point of substance, the current situation is that there are no complementary defence activities - such as mobilization plans - for DIPP to "hook onto". Thus, in the light of the admittedly non-exhaustive examination of this study, under present policies, defence considerations should not present any limits to DIP Program modifications.

It is critically important that this conclusion should be firmly established as it is easy to rationalize economically unrewarding activities by rather ill-defined references to defence aims.

On the other hand, given that the Program is worthwhile economically, then there are a number of no-cost or very low cost defence bonuses which could result from the (continuing) coordination of DIPP with the defence program. Amongst these bonuses is one which is often not fully appreciated: the enhanced morale in the CF from working with Canadian equipment and Canadian firms, with a particular facet being the generally high reliability of Canadian equipment and a resulting high level of confidence on the part of its Users.

Moreover, should defence policy and planning change to a more "conventional" war/industrial base concept, then the evidence of this study is that the program has the potential to contribute to the support of such a concept.

ADDENDUM TO DEFENCE RATIONALE FOR DIPP

DIPP OBJECTIVES

The following are the successive formal statements of the Objectives of the DIP Program as given in the DIPP Evaluability Report (Appendix I), September 1979.

1959-60

Objectives: To foster a sound Canadian industrial R&D base . . .

To participate in U.S. defence development and production . . .

To participate in Canadian development for which there will likely be a U.S. defence market . . .

1968

The purely military orientation of DIPP was modified by the addition of defence related civil high technology projects at the time DDP was disbanded, when DIPP was transferred to the Department of Industry (DOI), which had a mandate for all industry, not just the defence industry.

1970

Objective: To develop and sustain technological capability of Canadian industry for defence export sales or civil export sales arising from that capability.

Sub-Goals: To minimize cost of acquisition of equipment to DND.

To retain in Canada defence industrial capability to service and maintain advanced DND equipment.

To maximize industrial benefit from advanced technology and management techniques inherent in defence research, development and production.

1973

Major Objective:

As stated in the 1970 review, word for word.

Sub-goals: Not stated clearly, but implied as follows: To minimize costs of acquisition to DND. To enable Canadian industry to sell defence and defence-related civil products.

1977

Objective: To develop and sustain the technological capability of the Canadian defence industry for the purpose of generating economically viable defence exports and related civil exports.

Sub-Goals: To meet objectives of international defence development and production sharing arrangement. To support industry sector strategic objectives. To maximize economic return on resources employed.

THE "TECHNOLOGY" OBJECTIVE OF DIPP IN RELATION TO INDUSTRIAL R&D AND ECONOMIC GROWTH

APPENDIX F TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

THE "TECHNOLOGY" OBJECTIVE OF DIPP IN RELATION TO INDUSTRIAL R&D AND ECONOMIC GROWTH

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I - INTRODUCTION

The discussion of the "technological" objective of DIPP is complicated by many factors, the most important of which is lack of clear and consistent view of the status of the objective within the overall structure of the program. The lack of clarity and consistency have much to do with the historical development of the program and the shift in its focus and departmental affiliation. This short note is intended to contribute to an increase in the "fit" between the prevailing present view of the main objective of DIPP and its chosen instrument, that of providing grant support for R&D projects.

II - RELATIONSHIP BETWEEN TECHNOLOGY AND INDUSTRIAL GROWTH

Emphasis on R&D grants, although diminishing over the years, is the main method used to meet DIPP's objectives. This emphasis provides the clue for the assumption, built into DIPP, that the objectives of "technology" and of "economic growth" are well linked and can be jointly pursued. The link is suggested by many studies conducted during the last decades showing that there is a considerable, positive relationship between R&D intensity and economic growth. A typical statement of this relationship is found in the summary of papers[1] presented at the 1971 National Science Foundation Colloquium on R&D and Economic Growth/Productivity:

> Although what we know about the relationship between R&D and economic growth/productivity is limited, all available evidence indicates that R&D is an important contributor to economic growth and productivity. Research to date seeking

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[1] L.L. Lederman, Summary of Papers: Research and Development and Economic Growth/Productivity (National Science Foundation, December, 1971)

> to measure this relationship (at the level of the firm, the industry and the whole country) points in a single direction - the contribution of R&D to economic growth/productivity is positive, significant and high.

RECENT FINDINGS

During the 1970's, however, additional research into the relationship between R&D and growth has led to a number of caveats concerning the universality of the relation. A summary statement from the 1977 colloquium[2] points to these qualifications.

> Recent research has reinforced the earlier findings that the contribution of R&D to economic growth/productivity is high. In addition, the research on industrial R&D suggests the contributions differ by industry and by source of funding (e.g., government versus private). Also, the research shows that the economic benefits to society exceed substantially the returns received by the firms producing R&D outputs.
>
> (emphasis added)

In what follows, some of the major findings of research concerning R&D and growth, as well as insights from our own research, will be considered in terms of the light they may throw on the "technology" objective of DIPP. Unless

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2 R.R. Piekarz, Introduction and Summary: Relationship Between R&D and Economic Growth/Productivity, (National Science Foundation, November, 1977)

otherwise indicated explicitly, it is assumed throughout the discussion that (a) the "technology" objective is a means to achieving economic growth; and (b) that the objective has been operationalized primarily as promotion of technological capability through grants for R&D.

A recent article by Nestor Terleckyj,[3] an authority on R&D and growth, provides a summary of recent findings regarding the contribution of industrial R&D to economic growth and their implications for public policy. When the various findings are considered jointly, a paradox seems to emerge, as follows. R&D is good investment. It has high rates of return to the firm (estimated in some studies at between 20 and 30 per cent). Additionally, there are significant social returns (externalities) estimated by various studies to be as high as 55 to 80 percent. Such large positive externalities establish a strong presumption in favour of governments pouring funds into R&D. However, the studies also show that the high rate of return holds for industry-financed, but not for government-financed, R&D. In fact, the return to government financed R&D has been shown by various studies to be either negative or practically zero. Our own results concerning the economic return from DIPP projects tend to agree with this finding.

REASONS FOR POOR RETURN ON GOVERNMENT-FINANCED R&D

In order to clarify the policy implications of this paradox, it would be useful to know the reasons for the poor performance of government-financed R&D as compared with industry-financed R&D. Two general reasons are normally advanced, but it is admitted that the search for explanation of this fact has only begun. The two reasons are:

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3 N.E. Terleckyj, Recent Findings Regarding the Contribution of Industrial R&D to Economic Growth (Winter, 1977)

- The nature of the industries in which the bulk of government R&D is performed;
- The distorting influence of government grants on the firm's selection process for R&D ventures.

These reasons are elaborated below.

The bulk of government financed R&D is carried out in the electrical and aerospace industries. These are the industries in which return on R&D expenditures is the lowest. This fact has been established beyond dispute for the U.S.; a recent article by Steven Globerman[4] concluded that this is the case in Canada as well. Clarification of the importance of this finding is complicated by the fact that return to both government - and industry-financed R&D is low in these industries. This fact led Globerman to suggest that it is not so much the source of R&D (industry vs. government) which determines the rate of return, but the facts that (a) there are diminishing returns to R&D, and these are R&D intensive industries; and (b) R&D in these industries goes to defence-related companies, and these do not tend to exploit the market as well as others.

POLICY IMPLICATIONS

As will be seen below, this explanation for the paradox, if correct, can only be partial. This is because the findings reported by investigators showing

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[4] Steven Globerman, Sources of R&D Funding in Canada and Industrial Growth in Canada (Technological Innovation Studies Program Research Report. Ottawa, Dept. of Industry, Trade and Commerce, June, 1972)

low return to government financed R&D have held in all manufacturing industries, not only the two most heavily financed and most defence oriented. But even as a partial explanation, Globerman's suggestions may have important policy implications. The conclusions of Globerman and of Terleckyj are given, respectively, below. Despite differences in emphasis and wording, they are remarkably similar.

> [It] appears that in choosing policies to stimulate industrial R&D, the government is facing a tradeoff between the provision of improved "public type" goods [defence] and more rapid industrial growth. The provision of government contracts for research in the public goods area should not be expected to generate growth to the same extent as outright government grants to firms for performance of market oriented R&D or as indirect measures to stimulate increased private R&D funding.
>
> (Globerman, 1975, Executive Summary. ibid.)

> "One result of the research conducted in the 1970's is that less reliance is now placed on the spillover effects from government-financed R&D to economic growth. Distinctions are consistently made between private and government-financed R&D, and support of government R&D programs is increasingly being based on the benefits of R&D to that program. Any economic spillovers that result are incidental bonuses rather than a factor in a policy decision on what research is undertaken in support of a particular government program".
>
> (Terleckyj, ibid., p. 18, emphasis added)

The finding in this study of a weak correlation between contribution to defence and economic success is in line with these previous studies, as is our finding that a better return is achieved by civil-related than by defence products. The conclusion clearly emerges here that in order to use R&D as an instrument for promoting growth, government should not support R&D in defence related products and companies. It appears that this conclusion regarding the industry focus would hold regardless of the manner in which government encourages R&D.

III - EFFECTS OF GOVERNMENT FUNDING ON CORPORATE DECISIONS

A second approach to dealing with the implications of the findings of the relatively low return to government-financed R&D is to emphasize not so much the destination of the funds (electronics, aerospace, defence) but the decision-making distortions resulting from "free money".

Note that this explanation is not well developed in the literature. In fact, it is constructed here primarily on the basis of indirect evidence. The need for supplementing the first explanation is clear from the fact that the finding is not restricted to the sectors where the government performs the bulk of R&D.

Terleckyj hints at one possible source of problems when, in discussing policy alternatives to direct financing, he explains his preference for tax support:

> "Tax support has the advantage of reducing the cost of private R&D while leaving the remaining incentive

relationships and mechanisms for the selection of projects essentially undisturbed".

(Terleckyj, ibid., p. 18)

Regardless of the appeal of the tax mechanism alternative, the point is interesting. It suggests that the availability of large R&D grants from government may distort the project selection process in the firm. In other words, it leads firms, for some reason, to undertake "worse" projects than they would otherwise undertake. Again, this is clearly borne out by the results of this study: incremental projects do not do nearly as well as non-incremental projects in terms of economic return.

It is possible that the distortion results from the tendency of R&D grants to offer funds for the "wrong" component, or at the wrong time, of the innovation cycle. These grants tend to reduce the front end, technology related, costs (and risks) involved in the introduction of an innovation. These have repeatedly been shown to be much less important to decision makers than risks and costs involved in the development of markets.

MARKETING RISK

In a 1972 study of "Risks in new Product Development" in Canada, Blair Little[5] has shown that the perceived project risk of new products is unrelated either to the firm's perceived R&D strength or to its perceived manufacturing strength. "Differences in perceived strength in Marketing and Finance" were

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5 Blair Little, Risks in New Product Development (Technological Innovation Studies Program Research Report. Ottawa, Dept. of Industry, Trade and Commerce, June, 1972.)

another matter. It was apparent that "High PPR (Perceived Project Risk) was associated with Low perceived strength in both Finance and Marketing areas" (p. 18). Again, this is consistent with this study's conclusions that market risk is greater than technical risk and that perceived R&D strength is inversely related to economic payoff, while perceived marketing strength is positively related.

Roger More[6], in a study of the sensitivity of development risk to incentives, offers strong support for a similar point. He concludes that while managers are very sensitive to the potential loss in a new product venture, "their sensitivity to development cost incentives is relatively low, and apparently insensitive to the size of the development cost" (p. 23, my emphasis). Moreover, managers are sensitive to certain types of situational uncertainties, particularly to the competitive advantage expected. "This fact coupled with the relatively high sensitivity to market research incentives points to the potential value of greater incentives for companies to carry out more effective market research to attempt to reduce the uncertainties" (p. 25, emphasis added). This point is also supported in this study.

In a very comprehensive study of "Governmental Policies Towards Industrial Innovation" (1976), primarily in Britain and other European countries, Pavitt

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6 More, Roger A. Development of New Industrial Products: Sensitivity of Risk to Incentives (Technological Innovation Studies Program Research Report. Ottawa, Dept. of Industry, Trade and Commerce, January, 1979.)

and Walker[7] also offer support for the view that R&D support is needed most for marketing related activities. For example, they conclude that "attention to market demand is the most necessary ingredient for successful innovation, and that market uncertainty is in general the greatest uncertainty that innovators have to face" (p. 21). R&D managers, similarly, "consider themselves better able to estimate R&D costs and completion times than the size of markets for innovation" (p. 21).

This feeling of R&D managers, Pavitt and Walker point out, is borne out by the figures provided in Mansfield's calculations of probabilities of technical and market success based on the experience of laboratories in U.S. industry. The calculations show that of every 100 projects that were begun, 57 were completed technically, 31 were commercialized, and only 12 were market successes (p. 27).

IV - SPIN-OFFS

Beyond the direct or closely related development of an economically beneficial product, there is an additional link which is sometimes assumed between R&D and economic growth: the longer-term payoff resulting from technological spin-offs. It is worth observing that the existence of a net economic benefit from these spin-offs is difficult to disprove as the proponents can always extend the time period of gestation of this payoff; in a sense, its refutation is a form of proving a negative - always a difficult, if not unsatisfactory, exercise.

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7 K. Pavitt and W. Walker. Government Policies Towards Industrial Innovation: a Review. In: Research Policy, v.5, 1976, pp. 11-97.

The evidence from this study is that the case for spin-off is Not Proven. When the time-discounted value of money is taken into account, the likelihood of spin-offs appears as a dubious reason for directing support to any particular project or area.

Moreover, evidence is lacking that an uneconomic program is made economically beneficial by such spin-offs. The evidence from the responses we received from DIPP-supported firms is that the net present value (NPV) from the spin-offs is of the order of $15-20 million ($69) which, on a program in which the total (government plus corporate) investment is of the order of $1.1 billion ($69), is about 2% - an amount which would increase the program ROI by some 1/2%. Such a small increase would not significantly change the thrust of the findings.

In addition, studies of technological "ancestry" (the reverse of spin-off) indicate the diverse nature of the sources of concepts, ideas, and techniques. With present knowledge, these developments are neither predictable nor assured. Consequently, with present knowledge, there is no conclusive evidence that one type of industry or level of activity should be preferred over another as a recipient of R&D funding because of the potential for spin-offs. Specifically, investment in a number of industrial areas should, on these grounds, be considered as alternative to the current aerospace/electronic emphasis of DIPP.

V - CONCLUSION

All these studies, as well as our own results, appear to point in the direction of shifting the focus of government encouragement of internal industrial R&D away from direct research and development grants and toward aid in identifying, developing, and penetrating markets. In this light, the DIPP requirement that companies "show" a potential market which provides a certain return may be counter-productive in that it turns the most uncertain aspect of the process into a "given".

This last remark may sound paradoxical: it is a clear conclusion from this work that more emphasis and aid should be devoted to marketing, but the requirement as now stated could lead to the presentation of meretricious market analysis rather than to the presentation of some admittedly surface indications and a plan for solid study.

Throughout the foregoing discussion, the central underlying assumption has been that the purpose of supporting industrial research and development is the achievement of high economic return and the promotion of economic growth. If This assumption is retained, a twofold summary conclusion appears inescapable:

- Government support of R&D should shift away from electronics and aerospace, especially defence-related projects, to other manufacturing sectors.

- The focus of the support should shift from direct financing of technology to encouragement of firms to increase their own R&D. The most promising

instruments for encouragement are those which aid in identifying and creating markets for the resulting products.

If, on the other hand, this basic assumption is relaxed, and R&D support is intended to serve primarily the development of high technology as an end in itself or as a means to promoting Canada's defence capability, these conclusions lose much of their validity.

And this leads to an important conclusion concerning the structure of DIPP: R&D support can be a means to achieving economic growth, or it can be a means to achieving a defence related technological capability, but it cannot be a means to both at the same time. This is so because R&D support would have to have a different form and a different focus depending on which end is favoured. Further, it seems advisable that the objectives of DIPP be considered in the context of an overall strategy for industrial assistance on the part of the federal government.

ADDENDUM TO APPENDIX F:

HIGH TECHNOLOGY INDUSTRY - A TENTATIVE DEFINITION

High-technology industry may be defined as industry which has as its main line of material (including biological) products, or as a significant growing line, items which depend critically in their operation or performance on scientific phenomena which were first discovered in the past twenty-five years. It is inherent in this definition that high-technology firms must continually innovate.

RISK:

APPENDIX G TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

RISK:

APPENDIX G TO THE COVERING REPORT
OF THE DIPP EVALUATION STUDY

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I - INTRODUCTION

In technical parlance, "risk" is a measure of the variation around the expected (average) result which could take place. In common usage, however, the term is almost invariably used to refer to the danger of a shortfall in the ROI (or some other performance norm) on a project. It will be so used here. Basically, then, risk reflects the downside uncertainty concerning project outcomes.

There are a number of identifiable sources of risk including the following:

- Technical Risk - the possibility that the project will not prove to be technically feasible;
- Development Cost Risk - the possibility that the product development cost will be more than expected;
- Market Risk - the possibility that markets may not materialize or turn out to be less than expected, due to project cancellation or changed market conditions;
- Financial Risk - the possibility that failure of the project will adversely affect the future survival of the firm;
- Exchange Rate Risk - the possibility that an increase in the value of the Canadian dollar vis-à-vis foreign currencies will reduce profits on the project.

Since corporate managers are normally risk-averse, the uncertainty about project outcomes is a major consideration in decision-making and thus was one of the main subjects raised in the course of the interviews conducted in the course of the Case Studies. Among other things, firms were asked to describe how they assess risk and the impact of DIPP on their risk-taking behaviour.

II - RISK ASSESSMENT

Our findings indicate that there are three broad ways in which companies deal with risk:

a) Pure Risk Avoidance: in this mode of behaviour, the company simply does not go ahead with any project having more than a certain degree of risk, subjectively assessed, unless the work can be done on a cost-recovery basis.

b) Intuitive Risk Assessment: this includes a number of different but related types of behaviour. The most common way is for the company to intuitively (or subjectively) derive weights for the major elements of risk and then weigh the forecasts by the appropriate risk element.

c) Formal Risk Analysis: in a formal risk analysis the company varies the main risk factors (e.g., volume of sales, price and costs) and assesses the impact on the outcome of the project.

By and large, the DIPP firms follow the second (intuitive) approach; they often calculate what the "average" return (or pay-off) would be and then use their judgement to assess the variation that might occur. To a considerable degree, this approach is due to the view that the information available would not support a more elaborate form of risk assessment and decision-making.

Within this assessment, however, there are certain key parameters which come into play to determine a firm's ultimate decision. One of these is the loss which could be suffered with a non-negligible probability - in this case 10% was used as a reference point. R&D firms indicated that they would "rule out" a project which could lead to a loss of 2% of gross sales (at the 10% probability level). (For CA/SE firms, the figure was 1/2%.) This R&D figure is not a large amount ($2 million for a $100 million business) and indicates the degree of caution which exists in these companies.

Another perspective is provided by the average indication that for R&D firms, they would require a 47% probability that they would at least attain their corporate norm in the ROI for a project. Note that this is not the chance of "breaking even" (0% ROI) but the chance of reaching 17% (the ROI norm for R&D firms). This is still another indication that DIPP firms - for many quite understandable reasons - are not willing to take large risks.

As an associated point, it can be observed that the ROI norm data are consistent with a general view which emerges of the three groups of firms (CA/SE, non-Major R&D, Majors). These norms are: CA/SE - 10%; R&D - 17%; Majors - 23%. Their progression tends to support the view that the CA/SE group are more conservative and accept a lower return; the other groups represent increasing risk with a commensurately large return.

It also supports the view that, generally, decision-makers in firms will accept a high-risk project only if the expected ROI is commensurately high. In other words, decision-makers demand a "premium" on risky projects, which R&D projects (in contrast to CA/SE projects) tend to be and which premium has been the tradition, if not the current reality, in the large aerospace projects. Added evidence for the "risk premium" concept comes from the Pratt & Whitney (Canada) case study in which the return norms were: No Risk - 15%; Normal - 20%; High Risk - 25%.

LEVEL OF RISK

The evidence strongly suggests that, contrary to the early expectations of the study, the DIPP projects were not tremendously risky - even though 50% of the mini-case firms stated that the DIPP projects were the riskiest undertaken by those firms*. The table below gives the average rating for various risks assigned by the companies themselves by project category. The scale was from 1 to 7, where 1 was "No Risk" and 7 was "Absolutely Risky").

	CA/SE	R&D	Major
Overall	2.4	4.4	6.0
Marketing	2.2	3.5	2.8
Technical	2.0	4.3	3.3
Financial	2.5	3.8	2.7

*This means, also, of course that the other 50% of these firms judged that they had other non-DIPP projects which were at least as risky.

It can be seen that the marketing factor is not far behind the technical factor in this rating. The financial factor which represents the danger that the firm could suffer bankruptcy or, at least, a significant loss is also well in the running.

When firms were asked, however, what caused the actual problems in achieving a commercial success a somewhat different picture emerged. The tabulation of these results - which are from a 5-point scale, where 1 is "Not Responsible" and 5 is "Largely Responsible" - is given below:

	R&D	Major
Reduction in U.S. orders	3.0	4.5
Unexpected Competition	1.9	2.0
U.S. Producers More Favoured	1.4	1.0
Unexpectedly High Product Costs	1.9	2.0
Unexpected Technical Problems	3.0	1.0

From this tabulation, the marketing factor emerges as at least equal in importance to the technical problems for the mini R&D cases and as significantly more important for the Majors. Moreover, in the interviews, about 65% of the firms stated that, despite the judgmental nature of their risk assessment, they conducted some form of market assessment, thus demonstrating a sensitivity to this factor.

When all these observations are combined with the other interview information, we have no hesitation in recording that the marketing risk is at least as great a factor in the overall risk as any other and quite probably is the most significant.

The observations of the technical experts support the view that the DIPP projects, in general, are not very risky and that the technical risk is a bit lower than the "commercial" risk. (See Annex III, Expert Opinion Survey). In addition, this group sees the quality of the scientific staff, followed by the adequacy of the R&D facilities, as the most significant factors in creating or reducing risk.

The point regarding the calibre of staff is consistent also with the observation from more than one source that in R&D projects, one of the best guides is to invest in people.

A further though less critical risk dimension is the Exchange Rate. This can be a significant factor, particularly for firms engaged in export sales and with possibly long lead times from contract to final production. It is not a major item, in general, but it is one in which the DIP Program office might be able to assist, perhaps simply by helping firms to keep aware of "forward value" trends.

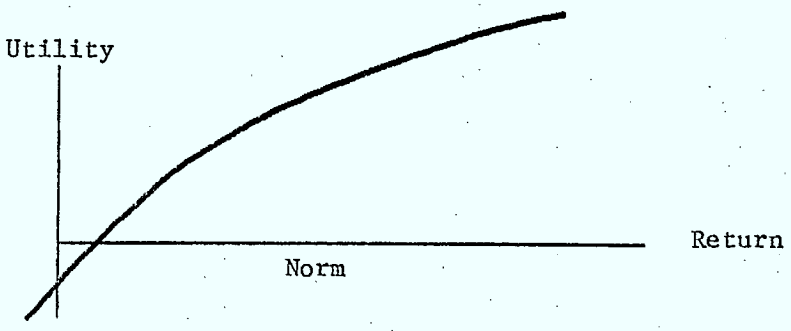
III - ROLE OF DIPP

From the standpoint of the companies, DIPP is certainly a risk-sharing program. Although not directly related to risk, DIPP also eases the liquidity problem which is endemic among the DIPP firms.

The direct relationship of DIPP to corporate risk - i.e., leaving liquidity aside - could be summarized as follows:

- The DIPP firms are clearly not reckless with their funds;
- Though the DIPP projects may not be risky in an absolute technical sense, they are risky, from a commercial perspective;
- The non-negligible chance (10%) of even a relatively modest loss (2% of gross sales) would block a project;
- The result, as can be observed from the economic performance of at least some of the incremental projects is that, without some form of protection against downside risk (i.e., loss) some economically worthwhile projects would not go ahead;
- Accordingly, there is some role for government to play in providing this protection, so as to increase the net economic benefits to the nation.

The foregoing description of the perceived corporate decision-making is consistent with those studies in Utility Theory which indicate that the worth attached to returns is definitely non-linear but falls off sharply below corporate norms. This is exemplified in the diagram below:



In such a situation, to refer again to the role of government, it could be rational for each individual firm to abstain from projects on the basis the the Expected Utility was too low; while, in fact, the overall Expected Return was equal or better than the norm, whether corporate or social.

The role of DIPP in protecting against loss should, however, not be overstated. DIPP's role in easing liquidity problems is at least, if not more, important. Moreover, that protection could take a variety of forms, as discussed in the Findings Section of the Covering Report.

IV - LIQUIDITY AND CANADIAN FINANCIAL INSTITUTIONS

From the observations gathered in this study, regarding the liquidity question, there seems little doubt that firms have considerable problems raising capital for DIPP-type projects.

There are quite understandable reasons for this:

- Financial Institutions have optional investments which yield equally good returns;
- These projects are commercially risky;
- There is generally very little tangible security which can be offered;
- This segment of industrial activity is largely unfamiliar to the financial institutions; they are "uncomfortable" in making the necessary judgements.

But, whatever the reason for the reluctance of the financial institutions, it is clear that it is not valid to criticize DIPP on the grounds that it is funding projects which are demonstrably poor since commercial sources of funds are closed to them. Rather, this structural/institutional problem in the economy provides a further justification for government intervention.

COMPETING SUBSIDIES:

APPENDIX H TO THE COVERING REPORT OF THE DIPP EVALUATION STUDY

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I - INTRODUCTION

An important theme in the original rationale for DIPP was that assistance was required for Canadian firms to "neutralize" the aid given to foreign firms in the defence and civil-related areas. Accordingly, as part of the evaluation of DIPP, a review was conducted of such assistance by other national governments and a comparison made with the DIPP levels. In addition, the effect of the foreign assistance on Canadian high technology exporters was also examined.

This appendix reports on this aspect of the Evaluation Study and draws together the results of the case studies and surveys, but is based primarily on a major study done by Dr. Alex Polianski, then of ITC, which study in its full version is available from the ITC Evaluation Coordinator.

To fully study this topic exhaustively would have required far more resources than were available. Consequently, only broad aspects could be covered. The evidence is such, however, as to allow firm generalizations.

II - DIPP RELATIVE TO FOREIGN AID

The first of these is that: Much more assistance is available abroad than in Canada: this is true of industrial assistance in general and defence and civil-related items in particular. Note that this aid extends not merely support for research, development, and production but to marketing in its broadest sense as well, and to all the intermeshing socio-economic and political systems (of which Japan's is the best known, but is not unique).

EXHIBIT 1

A. SUMMARY OF RANKINGS OF SELECT CANADIAN GOVERNMENT ASSISTANCE TO BUSINESS

TYPE OF ASSISTANCE	CANADA'S RANK	TOTAL NUMBER OF CASES STUDIED
National Accounts Current Subsidies in Compensation for Losses due to Policies of Price Maintenance, as Per Cent of GDP, for 1970-77	17	23
National Accounts Current Account Subsidies as Per Cent of Government Current Disbursement, for 1970-77	15	20
Per Cent of Total Business R&D Sources by Government, for 1975-76-77-78	6	10
Subsidies to Export Financing as Per Cent of Export Credits Outstanding at Dec. 31, 1977	7	8
Export Incentives and Other Assistance to Exports, for late 1970's	9	10

B. SUMMARY OF CANADA'S ACTUAL AND SELECT TRADE-PARTNER-EQUIVALENT OUTLAYS ON SELECT TYPES OF ASSISTANCE TO BUSINESS

$ million

	Actual Outlays	Select Trade Partner-Equivalents	Ratio of Select Equivalents to Actual Outlays
National Accounts Current Accounts Subsidies in Compensation for Losses due to Policies of Price Maintenance	2,380	2,664	1.119
Gov. Sourcing of Total Business R&D	112	666	5.946
Export Insurance Subsidies	26	83	3.192
TOTAL	2,518	3,413	1.355

By comparison, DIPP cannot be held to be generous, i.e., it is certainly not relatively generous in this context.

All governments extend cash and cash-equivalent aid to business in their domain. "Cash-equivalent" includes direct help such as tax concessions and assistance in financing, as well as indirect help via the institutional interlinking of government, banking, business, and industrial policies to create a framework which gives cost and non-cost advantages to domestic firms in production and selling. Canada ranks low in this regard in international comparisons amongst industrialized countries, as shown by Exhibits 1A and B, opposite.

Note that in the case of Export Incentives and Other Assistance, Canada did not rank the lowest (10) because the high evaluation of Canada's Trade Commissioner Service offset in part the lowest rank given to all other variables.

The extent to which outlays by the Canadian government would have to increase just to achieve equality with what is available abroad is shown in Exhibit 1B.

Note that the roughly one-third increase would make assistance equal; it would not necessarily yield a competitive advantage. In the case of products which are not price-sensitive, much more might be required, but note also price-insensitivity can also work to the advantage of certain Canadian producers, as will be discussed later in this appendix.

There is a general policy point which should be made at this juncture. Subsidies are a form of aid which fits naturally into governmental thinking on the supply side of the (economic) demand-supply relationship. It is worth noting that many successful forms of government aid (e.g., in Japan) operate on the demand side.

It may be concluded, then, that in general terms Canadian aid to industry, and in particular, DIPP, is certainly not excessively generous. Whether an increase in aid in the form of DIPP is optimal or even required is another and larger question.

III - THE NEW GATT

The new General Agreement on Tariffs and Trade (GATT) - the so-called Tokyo round - has created a changed environment within which high-technology export business must be conducted.

GATT codes and regulations of trade behaviour are "contracts" subject to interpretation, as are all contracts. Administrative interpretation, and the resulting de facto implementation, by GATT member-governments must be expected to seek out ways and means of favouring their own cause, possibly to the detriment of others. At the minimum, it should be underscored that the new climate provides the opportunity for legalistic maneuvering.

Paradoxically - but, perhaps, understandably - assistance to business has been increasing rapidly as tariff barriers were being dismantled in recent years. The Tokyo Round, by not "rejecting" but rather confirming the acceptance of

such assistance on grounds of derived social benefits, has facilitated the retention of such aid as subsidies, etc. At the same time, the likelihood of countering measures (referred to here as counter-sanctions) has increased as well. Member nations will still try to protect domestic industries against "new" encroachments.

RESTRICTIONS ON MARKET ACCESS

A continuing feature in the new GATT is that defence materiel is totally excluded, i.e., there is no right of access to defence markets. Such items are seen to affect essential national interests and security. Consequently, the defence sharing agreements into which Canada has entered (DDSA, DPSA, MOUs) remain essential as facilitators of defence exports.

The concept of "essential national interest" is intriguing. Sweden, for example, has recently successfully claimed that the production of footwear in Sweden is of national interest, thereby protecting its own footwear industry against imports from abroad. "Essential national interest" can, apparently, be broadly interpreted. Concern must be felt, therefore, that the "merging" of military and civil-related items could lead to further restrictions of access abroad for a wide range of high-technology products. (This merging results from the commonality, e.g., in electronics, of defence and civil items.)

Another feature of the new GATT which is of interest to DIPP is that a number of high-technology products have been excluded from the supposed broadening of access to government procurement: heavy electrical machinery, transport and telecommunications equipment, and data processing machinery.

Moreover, in the largest export market, the U.S., even agreed-upon items are subject to "set-asides" for small business, ethnic minority business, and labour surplus areas. These set-asides have made heavy inroads into defence purchases. It is estimated that about 20% of DOD material purchases falls in this category. And considering that these purchases are rarely in the areas of major weapons systems or sensitive items (e.g., nuclear) from which Canada is generally excluded in any case, the set-asides have become a major constraint on Canadian defence exports.

Amongst civil-related items, trade in commercial aircraft is of considerable significance to DIPP. That trade was liberalized in Tokyo, but only to the extent of removing all excess duty and import charges. In addition, however, there is a call for military R&D expenditures related to a civil product to be included in the price. To this extent, therefore, DIPP, which could have been seen to have thrown a defence cloak over government assistance, has become less able to protect these civil products against countering actions abroad.

(DIPP has never, of course, addressed another area in which competition occurs, namely, the financing of the sales of commercial aircraft. Canada is now attempting to secure an agreement whereby Canadian terms for such aircraft as the DASH-7 and the stretched Challenger would extend to 12 years. In the U.S., by way of contrast, normal terms currently cover 15 years).

ACCEPTABLE FORMS OF SUPPORT

In addition to addressing the question of opening up trade in general and within sectors, the new GATT has also addressed the question of "acceptable"

forms of support. Main implications of this for a program such as DIPP are that:

- Repayment provisions can increase acceptability very considerably;
- Support which does not distinguish between domestic and export markets is, in general, quite acceptable.

Both of these points are worth bearing in mind in any re-design exercise. And, in particular, it should be noted that tax provisions which do not differentiate between markets at home and abroad would "pass".

PROTECTIVE MEASURES

Final points should be made regarding the new GATT:

- Since GATT codes and regulations of trade behaviour are subject to legal interpretation, it would be worth considering the level and forms of support which the Canadian government should provide in what is anticipated to be the new growth industry of GATT litigation;
- The U.S. is creating a "Trade Complaint Centre" in its Department of Commerce, an entity which has a distinctly protectionist bias. This Centre will provide a forum where "the private sector can receive advice as to the recourse and remedies available for trade-related problems. The Department would also aid in the settlement of disputes, including the staffing of formal cases";
- Due to the high profile which applications to apply countervailing duties generally attract and the requirement that the appellant "expose" fully all support which he has received, it is quite likely that this instrument will not be the major one employed by domestic firms. There are, however, a number of other options, particularly with regard to the U.S.: Anti-dumping, Fair Trade Practices, etc.

The foregoing sections have discussed DIPP relative to the industrial support given by foreign governments and its possible effects on DIPP of the new GATT. The question remains: how have competing subsidies and aid affected the operation and performance of DIPP firms?

IV - EXISTENCE OF COMPETING SUBSIDIES

The DIPP firms were clearly conscious of the environment of support in which their foreign competitors operated. The following percentages of firms testified to the existence of such support:

Majors - 100%
Other R&D - 90%
Other CA/SE - 50%

Level of Support

The average effective level of support given to foreign competitors, in terms of the percentage of the selling price, was estimated by the firms as follows:

R&D firms - 15%
CA/SE firms - 17.5%

Effect of Competing Subsidies

Nevertheless, despite the awareness of the support and the indication that the level is, on the surface, not negligible, the strong evidence from the case studies is that for the non-aerospace firms, foreign industrial support is not a great threat. Almost universally, the testimony was that these firms

operate in areas where they have developed considerable expertise and where products generally sell on performance, not price, at least at differentials of about 15%-20%. Thus, we found that, when asked if competing subsidies were a factor in requiring DIPP assistance, only 12% of the R&D firms and 17% of the CA firms replied "Yes".

There is no doubt that the firms are conscious of being shut out of markets, generally by strong and overt actions to protect domestic defence firms. But it can only be concluded the neutralization of competing subsidies is not a requirement for the non-Aerospace DIPP family of firms.

For the aerospace group the evidence collected from the survey which was not comprehensive supports the view that foreign governments provide heavy, pervasive, and continuing support for this industrial segment. This support, however, is not uniform across the segment: it is heavier for military and large (prestige) commercial projects. Canadian firms have been able to develop niches in the general business and smaller commercial aircraft market where they were not directly competing with the heavily subsidized products.

For this aerospace group, we conclude that if the Canadian government wants to remain in the aerospace field, it should be prepared to provide to neutralize foreign support. It would probably be inefficient to do this on an automatic and blanket basis. Moreover, the topic would become a "high profile" item in large-scale projects which invariably are the subject of negotiation. In our view, the government negotiators should have access to some form of neutralizing support.

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