



Industry
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Evaluation of Technology Partnerships Canada Program

– Detailed Findings Report –

Audit and Evaluation Branch

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Canada

Table of Contents

	Page
1.0 Introduction	1
1.1 Overview	1
1.2 Program Profile	2
2.0 Methodology	5
2.1 Description of Methodologies	5
2.1.1 File and Document Review	5
2.1.2 Database Analysis	5
2.1.3 Interviews with TPC and IRAP Managers, Other Program Delivery Personnel and Other Informed Respondents	6
2.1.4 Telephone Survey of TPC, IRAP Clients	6
2.1.5 In-depth Interviews with TPC and IRAP Clients	8
2.1.6 Case Studies	8
2.2 Relationship Between Evaluation Issues and Methodologies	9
2.3 Study Limitations	14
3.0 Rationale / Relevance	16
3.1 Evaluation Issues	16
3.2 Detailed Findings	16
3.2.1 To what extent is TPC relevant to meeting government and industry needs for an industrial investment fund to maintain and increase economic growth and support sustainable development?	16
3.2.1.1 Government Needs	16
3.2.1.2 Industry Needs	21
3.2.2 To what extent has the national and international environment changed since TPC was created? Has TPC evolved to meet the changing conditions? Are TPC objectives still relevant?	24
3.2.3 What roles does TPC play in the government innovation strategy? How well is TPC positioned with respect to other initiatives within the Innovation Strategy? Is there overlap or duplication?	26
4.0 Progress in Delivering Program and Achieving Success	30
4.1 Evaluation Issues	30
4.2 Detailed Findings	30

4.2.1	Are TPC program objectives clearly understood by TPC managers and staff, stakeholders, clients and potential clients?	30
4.2.2	To what extent is TPC achieving stated program objectives? Were there significant contributing factors and impediments to TPC success?	35
4.2.3	Has the management of TPC achieved operational objectives related to administrative costs, percentage of project costs funded, and allocation of project funds between sectors (aerospace and defence, environmental and enabling technologies)?	50
4.2.4	To what extent have TPC funded projects achieved objectives identified in proposals and contribution agreements? Have technical and commercial success occurred? What have been the environmental impacts of TPC funded projects? What other impacts have occurred?	54
4.2.5	To what extent have the impacts of TPC funded projects extended beyond the funded firm to the larger industrial community?	63
4.2.6	To what extent have TPC funded projects led to long term job creation within the funded firms and beyond? What types of jobs have been created? To what extent has TPC helped develop highly skilled personnel for the Canadian innovative industrial community?	65
5.0	Program Design and Delivery	70
5.1	<i>Research Questions</i>	70
5.2	<i>Detailed Findings</i>	71
5.2.1	How satisfied are applicants and funded firms with program delivery (application, payment process, reporting requirements)? What suggestions do they have for change and improvement?	71
5.2.2	To what extent are project funding decisions consistent with program terms and conditions?	78
5.3.3	Who are the beneficiaries of the program? What is the profile of funded firms? To what extent is TPC reaching the intended target firms, including SMEs? How have co-delivery agents benefited from working with TPC?	79
5.2.4	To what extent has TPC formed effective partnerships with other program delivery organizations? In what manner have these partnerships helped TPC better deliver the program and achieve objectives? How has working with TPC helped partners?	88
5.2.5	Is TPC being delivered in an efficient and effective manner?	89

5.2.6	Are there changes to the design and delivery of TPC that could better deliver the program and / or achieve objectives?	96
5.2.7	What impact has the SOA status and structure had on TPC's ability to deliver the program, and achieve program objectives?	101
5.2.8	Is the SOA structure the most appropriate for TPC? Are there changes to the SOA authorities that can improve program delivery and achievement of success?	102
5.2.9	Are the responsibilities for management and delivery of the program and achievement of success clearly defined between Industry Canada, TPC and the Advisory Groups?	104
5.2.10	Does TPC have an operational Performance Measurement and Reporting System, that is used for program management, and that provides information required for annual performance reporting and periodic in-depth evaluation studies?	105
6.0	Lessons Learned	109
6.1	<i>Research Questions</i>	109
6.2	<i>Detailed Findings</i>	109
6.2.1	What specific lessons have been learned with respect to the delivery of TPC and the achievement of program objectives?	109
6.2.2	What factors have facilitated / impeded the effective delivery of TPC?	111
6.2.3	What factors have facilitated / impeded the achievement of TPC objectives?	112
Annex A – List of Acronyms		114
Annex B – Government Interviewees		115
Annex C – TPC Interview Guide for TPC / IRAP and OGD Managers ..		116
Annex D – TPC versus IRAP Survey Results		117
Annex E – Survey Results for Projects with Work Phase Completed and not Completed		118
Annex F – Survey Results by Type of Technology		119
Annex G – In-depth Client Interview List		120

Annex H – Case Studies	121
<i>H.1 TPC Funded Projects</i>	121
H.1.1 Messier Dowty - Aerospace and Defence Component (large firm)	121
H.1.2 MDS Aero Support Corporation - Aerospace and Defence Component (small firm)	121
H.1.3 IBM Canada - Enabling Technologies Component	121
H.1.4 Teleflex GFI - Environmental Technologies Component	121
<i>H.2 IRAP -PA Funded Projects</i>	121
H.2.1 MetTech Incorporated	121
H.2.2 Groupe ComTech Link / Smartsight	121

1.0 Introduction

1.1 Overview

The Technology Partnerships Canada (TPC) investment program was announced as part of the 1996 Budget Speech, to assist the federal government in responding to an identified innovation gap and a poor record among Canadian industry in the development and adoption of new technologies. TPC is a Special Operating Agency (SOA) within Industry Canada, with a mandate to stimulate wealth and job creation by strategically investing in firms to support technological development that fosters international competitiveness, innovation and commercialization.

In 1998, there was a ruling by the World Trade Organization (WTO) that TPC support for regional aircraft projects provided a defacto subsidy. To ensure that the program was in compliance with WTO rules, TPC developed new terms and conditions that moved the program away from support to commercialization and sales towards technological innovation and pre-competitive projects.

At the time of the restructuring in 1999, Treasury Board Secretariat identified the need for a formative evaluation in 2000-2001, four years after the creation of TPC. The evaluation was delayed, due to program changes. In preparation for the upcoming evaluation, TPC commissioned the development of an evaluation framework. The report **Technology Partnerships Canada Evaluation and Accountability Framework**, July 5, 2001, identified potential performance measures, and appropriate evaluation issues and methodological approaches.

This evaluation study is based on the approach recommended in that report, and the evaluation issues and methodological approaches are substantially the same. This report presents the detailed findings and evidence collected for the formative evaluation study of the TPC program, conducted for Industry Canada. The study includes information on all the TPC program elements, including those delivered directly by TPC and also by the Industrial Research Assistance Program (IRAP) of the National Research Council (NRC), the co-delivery partner.

The report is organized as follows:

- ▶ The remainder of this section provides a summary description of TPC and IRAP Pre-commercialization Assistance (IRAP-TPC).

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- ▶ **Section 2** describes the issues and methodologies used to address the evaluation issues and research questions.
 - ▶ **Section 3** addresses the relevance of TPC. More specifically, the section discusses the relevance of TPC as an industrial technology fund to support economic growth, the position of TPC within the government innovation strategy and how well TPC has adjusted to meet changing conditions.
 - ▶ **Section 4** deals with the progress TPC has made delivering the program and achieving success. The section addresses achievement of both operational program delivery objectives related to administrative costs and allocation of funds, as well as the degree of achievement of project objectives of technical and commercial success.
 - ▶ **Section 5** focuses on program design and delivery issues. These include identification and analysis of program beneficiaries, the level of client satisfaction with program delivery, and efficiency and effectiveness. Other issues examined include the appropriateness of the present Special Operating Agency structure and the quality and usefulness of TPC's performance measurement and reporting capability.

Throughout this report, a large number of acronyms is used. A list of the acronyms is provided in **Annex A**.

1.2 Program Profile

Technology Partnerships Canada is a technology investment fund that advances and supports government initiatives by investing strategically in research, development and innovation in order to encourage private sector investment, thereby growing the technology base and technological capabilities of Canadian industry. TPC operates as a Special Operating Agency within Industry Canada, with an independent budget and program delivery process, designed to meet the specific needs of the program.

TPC supports projects involving industrial research, pre-competitive development and / or studies in three strategically important sectors:

- ▶ aerospace and defence, including conversion of firms from dependence on military contracts;
- ▶ environmental technologies, primarily linked to sustainable development and improvements to the environment; and,

- ▶ enabling technologies that have major impacts within and across industrial sectors. These include applications of biotechnology, information technologies, manufacturing and processing technologies, and advanced materials.

TPC has a separate component group to deliver the program in each of these three areas.

TPC normally contributes 25 to 30 percent of eligible project costs, that include labour, material and other costs directly attributable to the project, as well as indirect labour, materials, supplies, general and administrative expenses, and specialized equipment. TPC does not support costs related to land and buildings.

TPC funding for the initial 1996-97 fiscal year was \$150,000,000, increasing to \$200,000,000 in 1997-98 and \$250,000,000 in 1998-99. In 2002-2003, the TPC budget was \$300,000,000. In the seven years since TPC was formed, over one billion in funding has been approved.

There are several stages to TPC projects:

Preapproval – at the beginning, firms wishing to access TPC funding support conduct an internal self-assessment to determine if their firm and the proposed project are eligible for TPC support. Firms can contact TPC for advice at this stage. If the firm believes that it is eligible, it then completes an Investment Outline, following a prescribed format, that describes the company, the proposed project, the benefits to Canada and the need for TPC support. Following review of the Investment Outline, TPC decides if the project is appropriate and if the firm should proceed to the next stage.

Approval and contracting – If the firm is successful at the Preapproval Stage, TPC invites the firm to develop and submit a detailed Investment Proposal. In the Investment Proposal, the firm provides a plan for the project, including a forecast of person-years (PY) of employment during the project work phase and in the benefits phase following completion of the project. If, after review by technical and business analysts, the project is accepted, it then moves to a more formal process of review by senior TPC and Industry Canada management. This stage typically takes three to six months. TPC negotiates terms for repayment of the contribution during this stage. Repayment is conditional, and is linked to the degree of commercial success of the project during the Benefits Phase following completion of the project work phase. If the project is accepted, the firm and TPC negotiate and sign a Contribution Agreement that identifies the terms and conditions of the funding and repayments.

Work Phase – once the contract is signed, the project moves into the work phase. During this phase, the company performs the work and submits invoices for eligible expenses for work completed, which are then paid by Public Works and Government Services Canada (PWGSC) on behalf of TPC. (In certain circumstances, because of the length of the approval and negotiation phases, project costs incurred before the Contribution Agreement is signed are eligible, up to 10% of the total project cost.) During this phase, the firm reports annually on actual person-years of employment and certain other financial information through the Annual Information Update (AIU). Major deviation from the plan or forecast levels of employment are identified and explained. The TPC project officer assigned to the project monitors the progress of the project during this stage.

Benefits Phase – In the Investment Proposal, the firm forecasts the level of commercial success anticipated, in the form of increased sales and employment, based on the successful completion of the project work phase. During the Benefits Phase, the firm continues to report annually through the AIU, on actual levels of employment, commercial success of the project (sales) and other related information until the end of the Benefits Phase, the length of which was negotiated at the time of the Contribution Agreement. TPC collects repayments during this phase, based on the sales information in the AIU.

Repayments are kept by TPC and added to the A-base funding provided through Industry Canada.

TPC's mandate is to provide assistance to individual firms of all sizes, large, medium and small. However, TPC processes are designed to fund larger, multimillion dollar projects of the type that are, in most cases, appropriate for larger firms. In 1998, TPC entered into an agreement with NRC's IRAP for the delivery of TPC support to small and medium sized establishments (SME) with relatively small projects. This part of the program delivered by IRAP, known as IRAP-TPC, provides up to \$500,000 to firms for projects costing up to \$1,500,000. This program element has a \$30,000,000 annual budget, with equal contributions from IRAP and TPC. The processes followed by IRAP-TPC are similar to those followed by TPC, but much less formal. Unlike TPC, which focuses on funding, often, an IRAP Industrial Technology Advisor (ITA) helps the firm develop the proposal and provides technical support during the project work phase. Because IRAP projects are smaller, the work phase is shorter, typically about a year.

2.0 Methodology

2.1 Description of Methodologies

The methodological approach used for the evaluation was based on the recommendations in the Technology Partnerships Canada Evaluation and Accountability Framework Report of July 2001. The basic philosophy is to identify a number of relevant, credible methodologies and use multiple lines of evidence to address each issue and research question. A brief description of the methodologies used is provided below.

2.1.1 File and Document Review

This approach, and the database analysis that is described below, provides the foundation on which other methods stand. A wide range of reports and documents were reviewed. These include:

- ▶ TPC annual reports and business plans from 1996 to the present;
- ▶ TPC project files;
- ▶ Sector and organizational level strategic plans and studies;
- ▶ TPC promotional and communications documents; and,
- ▶ Project press releases, Ministerial and Members of Parliament (MP) speeches.

Where available, similar material from the NRC IRAP-TPC was also reviewed.

In addition to program-specific material, selected reports and studies on innovation strategies and other innovation programs were reviewed.

2.1.2 Database Analysis

TPC makes use of the Industry Canada management information system software, known as CMIS, to collect basic information about each project. Information collected includes company name, location, size of project, project start and completion time, and other basic information. This database was analyzed to provide program level data about project size, and information about the profile of TPC supported firms.

IRAP has a similar database for the IRAP-TPC, and a similar analysis was performed.

2.1.3 Interviews with TPC and IRAP Managers, Other Program Delivery Personnel and Other Informed Respondents

In-depth personal or telephone interviews were conducted with a number of TPC and IRAP managers and staff, as well as other government personnel participating in the selection of TPC projects. In addition, interviews were held with several other informed respondents knowledgeable about TPC. The list of people interviewed is provided in **Annex B** and the interview guide in **Annex C**.

2.1.4 Telephone Survey of TPC, IRAP Clients

Telephone surveys of large samples of firms with TPC and IRAP-PA funded projects were undertaken. The sample sizes were large enough to reliably compare differences in the views of the clients of the two components of the program delivered directly by TPC and by IRAP. The samples included firms that had received funding over the complete time period since the beginning of the TPC and IRAP-TPC programs, covering firms whose projects were completed, as well as those still in the work phase. A structured questionnaire was developed and tested in actual field conditions. It was then revised, translated into french, and used to conduct the actual client interviews. The final versions of the TPC and IRAP-TPC client questionnaires are provided in **Annex D**.

A total of 90 TPC clients and 120 IRAP-TPC clients were interviewed. At the time of the survey, TPC had provided funding for 174 projects and 323 IRAP-TPC projects had been approved. These represented 133 unique organizations receiving TPC funding and 316 unique organizations receiving IRAP-TPC funding. Those organizations that had received funding for more than one project, were surveyed once, and project related questions were linked to only one of the funded projects (randomly selected). The accuracy of the survey results is shown in Table 1, which follows. Table 1 also provides details on the survey response rates.

As can be seen from the table, the response rate, particularly for TPC, was quite high and the survey results for both TPC and IRAP-TPC are fairly accurate at (Plus or minus) 6 - 7%. It is also important to note that, particularly for TPC where a very high proportion of clients were surveyed, there is a very low risk of non-response bias. That is, that those who were not surveyed would give different responses from those who were.

Table 1: Survey Accuracy and Response Rates

	TPC		IRAP-TPC	
<i>Survey Accuracy</i>				
Total number of projects funded	174		323	
Total number of completed survey interviews	90		120	
Accuracy of survey results to projects funded	±7.2%¹		±7.1%	
Total number of firms funded	133		316	
Total number of firms surveyed	90		120	
Accuracy of survey results to firms funded	±5.9%		±7.0%	
<i>Survey Response Rates</i>				
	#	%	#	%
Completed interviews	90	67.7	120	38.0
▸ Project completed	46	34.6	12	3.8
▸ Project not completed	44	33.1	107	33.9
▸ Project completion information not available	0	0.0	1	0.3
▸ Aerospace	25	18.8	5	1.6
▸ Environmental technologies	13	9.8	12	3.8
▸ Enabling technologies	50	37.6	97	30.7
▸ Type of project not available	2	1.5	6	1.9
No contact information provided	0	0.0	16	5.1
Wrong # / Not in service	15	11.3	44	13.9
Contact person no longer with firm	3	2.3	2	0.6
Did another survey on program recently / used for pretest / used for case studies	13	9.8	4	1.3
Not reached by end of survey	7	5.3	119	37.7
Has not received funding yet	0	0.0	1	0.3
Refused to participate / terminated partway	5	3.8	10	3.2
Total	133	100.0	316	100.0
¹ Therefore if 50% of the respondents indicated that the project had resulted in something, we can be reasonably confident that if all respondents had been surveyed for all projects, the actual response would be between 42.8% and 57.2% (i.e., 50 plus or minus 7.2).				

The detailed survey results are presented in annexes as follows:

- ▶ overall TPC versus IRAP-TPC survey results in **Annex D**;
- ▶ projects with work phase completed versus work phase not completed projects for TPC versus IRAP-TPC in **Annex E**¹ and,
- ▶ by area of technology (aerospace, environment and enabling technologies) for TPC versus IRAP-TPC in **Annex F**.

In addition, throughout the report, other analyses are presented, as appropriate. It should be noted that when reporting survey results, we refer to “clients” – these are the surveyed funded organizations.

2.1.5 In-depth Interviews with TPC and IRAP Clients

In addition to the telephone survey of a large sample of TPC and IRAP-TPC clients, in-depth interviews with seven TPC and four IRAP-TPC clients were conducted, in order to probe more deeply for client’s views on program relevance, design and delivery, and technical and commercial impact of the funded project on the firm². The list of interviewees is provided in **Annex G**.

2.1.6 Case Studies

Case studies were used to probe more deeply into the technical and commercial success of the funded project and the impacts of the project on the firm’s overall competitive position. A total of six case studies were completed, four of TPC projects (two in aerospace and defence, one in enabling technologies and one in environmental technologies) and two of IRAP-TPC projects. Case studies were chosen from early projects with a completed work phase, in order to examine the results of projects and impacts on the firm.

The approach to developing the case studies included review of project files, interviews with program delivery staff and client representatives. Draft case study writeups were

¹ Note: throughout this report, whenever we refer to completed / not completed projects, we are referring to the work phase.

² Note: in cases where the same questions were asked, the results of these interviews were included in the survey results. The 90 TPC survey interviews therefore include the results of the 7 in-depth interviews and the 120 IRAP-TPC survey interviews include the results of the 4 in-depth interviews.

sent to the client for confirmation / feedback. The individual case studies are provided in **Annex H**.

2.2 *Relationship Between Evaluation Issues and Methodologies*

The issues addressed in this study and the methodological approaches used are based on those identified in the Technology Partnerships Canada Evaluation and Accountability Framework. Each particular methodological approach has some strengths and some limitations, and careful combining of methods can minimize limitations. As mentioned previously, multiple lines of evidence were used to address each evaluation issue, in order to provide maximum confidence and credibility, as well as a firm foundation for the conclusions.

Table 2, which follows, identifies the specific issues and the extent to which each methodology contributes to the various issues.

Table 2: Relationship Between Evaluation Issues and Methodological Approaches

Evaluation Issues	Doc / File Review	Data Base Review	Gov't Interviews	Client Survey	Client Interviews	Case Studies
Rationale / Relevance (see Section 3)						
To what extent is TPC relevant to meeting government and industry needs for an industrial investment fund to maintain and increase economic growth and support sustainable development?	M	L	H	H	M	M
To what extent has the national and international environment changed since TPC was created? Has TPC evolved to meet the changing conditions? Are TPC objectives still relevant?	M	L	H	H	L	L
What roles does TPC play in the government innovation strategy? How well is TPC positioned with respect to other initiatives within the Innovation Strategy? Is there overlap or duplication?	H	L	H	M	M	L
Progress in Delivering Program and Achieving Success (see Section 4)						
Are TPC program objectives clearly understood by TPC managers and staff, stakeholders, clients and potential clients?	M	L	H	H	M	M
To what extent is TPC achieving stated program objectives? Were there significant contributing factors and impediments to TPC success?	M	L	H	H	M	M
Has the management of TPC achieved operational objectives related to administrative costs, percentage of project costs funded, and allocation of project funds between sectors (aerospace and defence, environmental and enabling technologies)?	M	M	H	L	L	L

Table 2: Relationship Between Evaluation Issues and Methodological Approaches

Evaluation Issues	Doc / File Review	Data Base Review	Gov't Interviews	Client Survey	Client Interviews	Case Studies
To what extent have TPC funded projects achieved objectives identified in proposal and contribution agreements? Have technical and commercial success occurred? What have been the environmental impacts of TPC funded projects? What other impacts have occurred?	M	L	M	M	H	H
To what extent have the impacts of TPC funded projects extended beyond the funded firm to the larger industrial community?	M	L	M	M	M	H
To what extent have TPC funded projects led to long term job creation within the funded firms and beyond? What types of jobs have been created? To what extent has TPC helped develop highly skilled personnel for the Canadian innovative industrial community?	M	H	M	M	H	H
Program Design and Delivery (see Section 5)						
How satisfied are applicants and funded firms with program delivery (application, payment process, reporting requirements)? What suggestions do they have for change and improvement?	L	L	M	H	H	M
To what extent are project funding decisions consistent with program terms and conditions?	H	L	M	L	L	L
Who are the beneficiaries of the program? What is the profile of funded firms? To what extent is TPC reaching the intended target firms, including SMEs? How have co-delivery agents benefitted from working with TPC?	H	H	M	M	L	L

Table 2: Relationship Between Evaluation Issues and Methodological Approaches

Evaluation Issues	Doc / File Review	Data Base Review	Gov't Interviews	Client Survey	Client Interviews	Case Studies
To what extent has TPC formed effective partnerships with other program delivery organizations? In what manner have these partnerships helped TPC better deliver the program and achieve objectives? How has working with TPC helped partners?	M	L	H	L	L	L
Is TPC being delivered in an efficient and effective manner?	M	M	H	M	M	M
Are there changes to the design and delivery of TPC that could better deliver the program and / or achieve objectives?	M	M	M	H	M	M
What impact has the SOA status and structure had on TPC's ability to deliver the program, and achieve program objectives?	M	L	H	L	L	L
Is the SOA structure the most appropriate for TPC? Are there changes to the SOA authorities that can improve program delivery and achievement of success?	M	L	H	L	L	L
Are the responsibilities for management and delivery of the program and achievement of success clearly defined between Industry Canada, TPC and the Advisory Groups?	H	L	H	L	L	L
Does TPC have an operational Performance Measurement and Reporting System (PMRS) that is used for program management, and that provides information required for annual performance reporting and periodic in-depth evaluation studies?	H	M	H	L	L	L

Table 2: Relationship Between Evaluation Issues and Methodological Approaches

Evaluation Issues	Doc / File Review	Data Base Review	Gov't Interviews	Client Survey	Client Interviews	Case Studies
Lessons Learned (see Section 6)						
What specific lessons have been learned with respect to the delivery of TPC and achievement of program objectives?	L	L	M	M	M	M
What factors have facilitated / impeded the effective delivery of TPC?	L	L	M	H	M	L
What factors have facilitated / impeded the achievement of TPC objectives?	L	L	H	H	M	L

H – high importance
M – moderate importance
L – low / no importance

2.3 Study Limitations

Every evaluation study has certain limitations, resulting from the level of resources available and the methodologies chosen. Table 3, below, summarizes the strengths and limitations of each of the methods used.

Table 3: Strengths and Limitations of Study Methodologies

Methods	Strengths	Limitations
Document, file review	provides factual information to provide background, support other sources	usually does not relate directly to study issues; must be complemented with other sources
Database analysis	similar to file review, provides factual information, basis for client surveys	provides basic profiling information about program delivery
Interviews with TPC, IRAP, OGD managers	program staff input essential to provide context, specific knowledge of design and delivery issues	input is combination of fact and perception; may be biased; needs to be compared to other sources
Client surveys	important source for client perspective on program relevance, needs, quality of service and benefits resulting from project; large sample sizes provide representative results	perception is not fact, comments cannot be proven; perspective is project specific
In-depth client interviews	provides more in-depth responses to issues of relevance, delivery and project impacts	not representative due to small number
Case studies	provides in-depth analysis of how projects are carried out, specific project technical and commercial impacts on the firm, within the larger business environment	not representative or generalizable; chosen to demonstrate certain project types and the nature and extent of benefits that can occur

The methods used in this study have been chosen to fit best with the requirements for a predominately formative study that is designed to identify opportunities for program adjustment and improvement, with less emphasis on examining in detail the full extent of program impacts. For this reason, this study does not examine program incrementality or examine in detail the socio-economic impacts of the program.

Another issue is the question of timing. As stated in the 2002-2003 Business Plan, TPC has been in the midst of significant change for many months. The organization has just

implemented a major organizational restructuring, adding new management positions. Other studies are underway regarding adjustments to the TPC business model and delivery processes. More recently, as of April 1, 2003, IRAP TPC is delivering the program to SMEs with projects up to \$3,000,000, doubling the size previously supported. These changes make TPC somewhat of a moving target. Evidence for this study was collected mainly between January and March, 2003, and the analysis, conclusions and recommendations are based on TPC as it existed at that time.

3.0 Rationale / Relevance

3.1 Evaluation Issues

To what extent is TPC relevant to meeting government and industry needs for an industrial investment fund to maintain and increase economic growth and support sustainable development?

To what extent has the national and international environment changed since TPC was created? Has TPC evolved to meet the changing conditions? Are TPC objectives still relevant?

What roles does TPC play in the government innovation strategy? How well is TPC positioned with respect to other initiatives within the Innovation Strategy? Is there overlap or duplication?

3.2 Detailed Findings

3.2.1 To what extent is TPC relevant to meeting government and industry needs for an industrial investment fund to maintain and increase economic growth and support sustainable development?

The issue of relevance will be separated into two sections, relevance to government needs and to industry needs, with government needs being addressed first.

3.2.1.1 Government Needs

Evidence to address this question comes from a number of sources. Documents reviewed include independent reports, government policy documents, TPC reports and speeches by Ministers and Members of Parliament. Interviews with staff from TPC, NRC's IRAP and other government departments involved in delivering the program also provided information.

Document and File Review

The 1991 Porter report "Canada at the Cross Roads - the Reality of a New Competitive Environment" provides background to this question. The report identified a number of factors under the control of government that were deemed important. These included the need to increase the amount of R&D performed in the private sector, and to lever increased contributions from industry. Another was to respond to need and build on success, rather than impose conditions such as regional balance that would limit or negate

the value of the intervention. The Porter report examined the issue of competitive advantage from an international perspective, and identified four major items that formed “The Diamond”. These were:

- ▶ factor conditions - the nation’s natural, social and economic factors of production (availability of appropriately skilled labour, natural resources, technical and physical infrastructure and capital);
- ▶ demand conditions - home market demand often forms a base for international sales;
- ▶ related and supporting industries - access to home-based suppliers and related industries were found to create advantages in downstream industries. Related industries include those developing enabling technologies of value to a range of firms; and,
- ▶ firm strategy, structure and rivalry - domestic and international rivalry that forces firms to compete, drive technical change, innovation and ultimately achieve economic success.

The report also made a number of recommendations, several of which relate to TPC. These include building on existing strengths and competitive advantage, and supporting innovation, technology development and adoption by industry. Another recommendation was to support the development of clusters of primary and supplier firms, found to be important in creating competitive advantage.

A recent report entitled “Signs of Life: The Growth of Biotechnology Centres in the U.S.” by the Brookings Institution outlined a number of key conditions and resources necessary for the development of a biotechnology industry. It was pointed out that biotechnology as an industry is at an early stage of development and maturity, and will be subject to many changes as scientific and technological innovation continues and commercial markets develop. Key conditions identified in the report include the benefits of clustering, as identified by Porter, as well as the need to accept risk and failure, and to provide patient capital. The report also identified the requirements for private sector investment in product development to complement pre-commercial medical and university-based research.

More directly related to the relevance of TPC are background documents linked to the decision in the mid 1990s to create TPC that point to the need to provide a fiscally responsible program supportive of the government’s objectives of jobs, growth and sustainable development by:

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- ▶ supporting existing high technology sectors that can take their technologies successfully to the marketplace;
 - ▶ supporting private sector development of technologies that have widespread beneficial spillover effects on productivity throughout the economy; and,
 - ▶ attracting and holding “footloose” investment in Canada.

The need to provide a program to fill the gap in federal support for private sector technology development at the post-R&D, pre-commercialization stage was also identified. In addition, the documents discussed the continued need, following the substantial cuts to private sector funding as a result of Program Review in 1994, for support to the aerospace sector following the termination of the Defence Industry Productivity Program (DIPP) and by the environmental and sustainable development sector following termination of the Environmental Technology Commercialization Program.

The Speech from the Throne on February 27, 1996 reflected the commitment of the government to the formation of Technology Partnerships Canada as a key element of the Government’s Jobs and Growth Agenda. The relevant passage was:

Science and Technology

To create enduring jobs for Canadians in the economy of the 21st century, investment in knowledge and technology is essential. The Government will establish guiding principles to improve the effectiveness and focus of the federal science and technology effort. In particular:

- ▶ *the Government will make specific proposals to support technology development in the aerospace industry, in environmental technologies and in critical enabling technologies such as biotechnology...*

As stated in the 1996-97 TPC Annual Report, TPC is designed to stimulate wealth and job creation by strategically investing in technological development that fosters international competitiveness, innovation and commercialization as well as increased investment in Canada. TPC’s objectives are supportive of those of its parent department Industry Canada, which are to:

accelerate economic growth and job creation in the context of an increasingly open, knowledge-based economy by:

-
- ▶ *developing a climate in which the private sector can grow faster than it would on its own;*
 - ▶ *creating competitive advantages for Canadian firms relative to foreign competitors; and*
 - ▶ *increasing national productivity.*

Since its formation in 1996, government documents show that TPC has remained relevant to government objectives for innovation and increased attention to the knowledge-based economy. For example, the Speech from the Throne opening the first session of the 37th Parliament spoke of the need to accelerate Canada's ability to commercialize research discoveries and turn them into new products and services. The Government has also made a commitment to improving our environment and reducing the production of greenhouse gases (GHG). TPC is designed to help achieve both these objectives.

A review of news releases and speeches by Ministers and Members of Parliament announcing TPC funding also provides evidence of the linkage between TPC and government objectives. For example, in announcing a TPC contribution to Aetena Laboratories of Québec City in November, 1999, the Minister of Industry stated that "the Speech from the Throne recognized the need to bolster our dynamic knowledge-based sectors in which new technologies and innovations generate jobs, growth and wealth". The TPC contribution of \$29.4 million supported projects that were estimated to create or maintain 722 highly skilled jobs at the biopharmaceutical firm. The news release also reported that TPC funding also contributed to Aetena Laboratories' decision to undertake a \$16 million upgrade of its production facility in preparation for clinical trials.

Other news releases between 1996 and the present reflect the role that TPC funding plays in supporting government strategic objectives of connectedness, e-commerce, sustainable development, reduction in use of non-renewable resources, and maintaining a strong aerospace sector.

An article in Research Money showed another way in which the Government makes direct and explicit use of TPC as an instrument of public policy. On February 7, 2003, Canada signed a Memorandum of Understanding (MOU) with the U.S. for the system development and demonstration phase of the Joint Strike Fighter (JSF) project, to develop a multi-use, low cost next generation fighter aircraft, to be known as the F-35. The MOU commits Canada to providing \$240 million over the next ten years to the project, from the Department of National Defence and TPC. TPC's role will be to

contribute at least \$80 million to projects by Canadian aerospace firms undertaking JSF-related work.

A file review of a sample of project proposals also showed that, in some cases, TPC contributions help fund the transfer and commercialization of technology from government laboratories, which is another government objective.

The 1996-97 TPC Business Plan noted that one priority of the government was the implementation of the jobs and growth strategy with a focus on small and medium sized establishments (SMEs). The first Annual Report reported that about 85% of the funding for the first year went to large firms, and identified the need to find a partner to deliver the program to SMEs in a decentralized, non-bureaucratic manner. By 1997, documents show that TPC had reached an agreement with IRAP for the delivery of relatively small projects (less than \$1,500,000) to SMEs. This initiative was funded 50/50 by TPC and IRAP, with each contributing \$15,000,000 annually. The procedures for applying, reviewing and managing this initiative were more streamlined than those of TPC for the larger projects. In 2000-2001, the IRAP-TPC initiative funded 82 projects valued at \$32,000,000, compared to 28 projects valued at \$499,000,000 by TPC directly.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Comments by TPC and other government departments (OGD) officials also generally supported the role played by TPC as a government instrument to create and maintain jobs in selected, strategically important, knowledge intensive sectors of the economy, namely aerospace, environmental and enabling technologies. Several interviewees pointed out that the program was designed specifically to meet these needs. One interviewee noted that TPC was the latest in a long line of government programs over many years that have been designed to assist the aerospace community, the most recent being DIPP. Another interviewee commented that, following Program Review in the mid 1990s, Industry Canada cancelled programs providing financial assistance to private sector firms, to focus on providing non-financial support to the broader industrial community. In this respect, within Industry Canada, TPC is an anomaly. The interviewee was concerned that firms, particularly those in the environmental and enabling sectors, would devote too much effort seeking government financial support, with a small chance of success, rather than improving their competitive position through their own efforts.

IRAP officials interviewed noted that IRAP-TPC filled a gap in government support to SMEs by providing financial assistance to firms that was a natural complement to the earlier R&D stage support provided by the regular IRAP program. They considered it to be a relevant continuation of IRAP support.

Case Studies

The case studies provide specific examples of how TPC funded projects help address government needs. One government need identified in the document review is to encourage footloose capital to remain in Canada. The IBM case study is an example of TPC funding meeting this objective, as it showed how TPC funding support was a key factor in the Toronto Software Development Laboratory receiving major software development work in competition with IBM software development laboratories in other countries. Similarly, the Teleflex GFI case study provided an example of how government support helps a firm develop products that reduce pollution and greenhouse gases, and support sustainable development. The two case studies associated with aerospace firms provide examples of how TPC helps achieve government objectives related to maintenance and continued development of a world class, competitive aerospace industry.

3.2.1.2 Industry Needs

Evidence to address this question came from a review of external reports, project proposals, interviews with TPC and OGD representatives, the client survey and in-depth client interviews.

Document and File Review

The 1991 Porter Report “Canada at the Cross Roads - the Reality of a New Competitive Environment” also made a number of recommendations related to industry. These included building on existing strengths and competitive advantage, and supporting innovation. The report also suggests that Canadian subsidiaries of international firms should strive to develop a North American or world market mandate for specific products or business lines. The report also suggested that encouraging the development and use of local suppliers and establishing links with Canadian-based firms in related industries are successful strategies that should be followed.

A recent market study of SMEs that had made use of IRAP-TPC found that the program addressed one of their greatest needs – financial assistance for product / process development. Costs typically increase as the project life cycle moves from R to D to pre-commercialization, and IRAP-TPC provides assistance at the later stage, when many other sources are unavailable, particularly for start-up firms without strong cash flow. The study also found that the guidance and advice provided by the IRAP Industrial Technology Advisor met a very important need for SMEs, and complemented the financial assistance.

TPC documents clearly show that TPC only supports firms in specific, strategically selected industrial sectors: aerospace and defence, environmental technology and enabling technologies (biotechnology, information technology and advanced materials). It therefore can meet industrial needs only in these sectors. A sample of project proposals provided by firms receiving TPC and IRAP-TPC funding support was reviewed to identify the specific needs that TPC funding is addressing. Based on this review, the main categories of firm needs being met by TPC and IRAP-TPC funding include:

- ▶ inadequate internal financing available;
- ▶ need to move quickly to undertake and complete a project / initiative to hit a window of opportunity;
- ▶ need to build technical capability quickly; and,
- ▶ requirement to compete with companies in other countries that provide assistance.

All projects funded by TPC and IRAP-TPC must be incremental in order to be accepted. This means that, without the government financial contribution, the project would not proceed at all, or would be so much slower or reduced in magnitude as to seriously affect the likelihood of success. In some cases reviewed, where Canadian firms are bidding for subcontract work, documents suggested that the lack of TPC support would almost certainly mean that the company would lose the competitive bid as a result of higher costs compared to those of firms from other countries.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

TPC and Industry Canada Sector officials consistently noted that the TPC program was designed to meet private sector needs for financial assistance to support high risk innovative projects in selected sectors. Interviewees noted that, in the case of aerospace and defence, the program more or less met the needs of the sector, whereas for the other sectors, TPC only meets the needs of those firms receiving funding, not the sector. This is due to the limited level of funding available for the enabling and environmental technologies program areas and the small percentage of proposed projects that are funded. This will be discussed in more detail in Section 5.3.

IRAP managers and staff interviewed stated without exception that most small and medium sized firms supported find IRAP-TPC relevant as a follow on to the R&D projects funded by IRAP. Many firms were said to recognize that there remains a

significant amount of work to be done before a product or process is commercially viable, and that this stage is in general less risky than the R&D phase, as the technology has been developed. Consequently, firms are willing to share the risk and repay the IRAP-TPC portion if the firm benefits.

Client Survey

The survey of TPC clients revealed that, when they decided to approach the program for project assistance, about half (51%) the clients were looking for funding to undertake research and / or development projects. The next most frequently mentioned need was funding for new technology or software which was noted by 14% of the TPC clients. The needs identified by IRAP-TPC clients were only somewhat different. The three top responses were:

- ▶ funding or assistance for commercialization (33%);
- ▶ funding for research and / or development (21%); and,
- ▶ funding for new technology or software (13%).

When asked to what extent the program was able to address their needs, TPC and IRAP-TPC clients were equally likely to indicate that the program had met their needs. That is, on a scale of 1 (not at all) to 10 (fully), 75% of TPC clients and 73% of IRAP-TPC clients gave ratings of 8 or more in terms of the program's ability to meet their identified needs. The average (mean) ratings were 8.4 for TPC and 8.1 for IRAP-TPC. Not surprisingly, the most frequently stated reason given for noting that the program had met their needs was that they received the money (37% for TPC and 28% for PA). Another response provided by many respondents from both groups was that it is a good program with good, professional and supportive personnel (23% for IRAP-TPC and 14% for TPC). IRAP-TPC clients (13%) also noted the access to more than just money (e.g., advice, assistance in developing business plans, networking, etc.).

In-depth Client Interviews

Most TPC clients interviewed were supportive of the program, as a responsible approach to assisting Canadian firms to meet needs related to the development of new technologies and products. One interviewee noted that, as a Canadian taxpayer, he was supportive of the program requiring repayment if the project was commercially successful, providing that the funds were reinvested in the Program. IRAP clients also confirmed that IRAP-TPC met their needs for a non-bureaucratic method of accessing conditionally repayable funding.

Case Studies

The case studies provide evidence in specific projects of the role played by TPC in meeting government and industry goals related to innovation, increased competitiveness and economic growth. All six case studies describe projects that were technically successful, and led to incremental employment. In these cases, TPC acted as an industrial technology fund that provided access to conditionally repayable funding to support the firm's technological development, innovation and economic growth. In all cases, the projects increased the technological capacity of the firm and improved their competitive position. (More detailed discussion of the technological and commercial success of the projects examined in the case studies will be provided in Section 4.)

3.2.2 To what extent has the national and international environment changed since TPC was created? Has TPC evolved to meet the changing conditions? Are TPC objectives still relevant?

This question was addressed mainly through a review of key TPC internal documents and interviews with TPC, Industry Canada Sector Branch and IRAP personnel.

Document Review

A review of TPC annual reports, business plans and related documents shows a number of changes that TPC has adopted over the years in response to identified changes in the national and international environment.

The most important change in TPC since 1996 was due to the international environment. As outlined in the 1999-2000 Business Plan, the 1998 World Trade Organization review of TPC's role in supporting the Canadian regional aircraft industry, and the subsequent decision that TPC was operating as a de facto export contingency caused a major change in the way TPC was delivered. As reported in the 1999-2000 Annual report, in early 1999, TPC cancelled all applications in progress for investments related to aerospace. Program design and delivery was modified and moved slightly away from support for close-to-market projects towards late stage R&D and earlier stage pre-commercialization projects. As part of this change, any reference to export sales to be achieved through TPC funded projects was removed from project proposals used by TPC in making funding decisions. TPC also moved away from collecting repayments based solely on royalties tied directly to specific product sales, towards a broader assortment of repayment approaches, including royalties on total firm sales (in some cases above a threshold level) and warrants.

TPC has also made adjustments to respond to changing conditions in the competitive position of the Canadian aerospace supplier group (Tier 3 and Tier 4). In April, 2001, in response to a study co-sponsored by the Aerospace Industries Association of Canada and

Industry Canada Automobile and Aerospace Sector Branch that showed that Tier 1 aerospace firms were placing increased technical and quality assurance requirements on Tier 2 and 3 suppliers, TPC added a 3-year pilot project known as the Aerospace and Defence Supplier Development Initiative. This initiative is intended to help small and medium sized firms supplying the aerospace and defence sector to develop and incorporate world-class business and manufacturing practices and technologies. This program has a specific budget of \$30 million over 3 years. Like the IRAP-TPC, this initiative has a more streamlined approval and repayment process than TPC. Another pilot program, entitled the Canadian Aerospace Collaborative Technology Development program was also introduced at the same time, with a budget of \$9 million over three years, to encourage early stage R&D collaboration in this sector.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

A number of interviewees noted that TPC had modified and improved its program delivery based on experience gained since the program began. There have been significant adjustments in the project selection process and the approach to repayments. This has been particularly true in the Environmental and Enabling Technologies areas that focus on development of technology, where the original product development approach derived from DIPP is less appropriate. These will be discussed in more detail in **Section 5**. Some interviewees also noted that there are many more proposals for funding of environmental and enabling technology projects than TPC can fund under the existing allocation guidelines. In recent years, less than the original guidelines of 66% of the funds have been going to the aerospace and defence sector.

3.2.3 What roles does TPC play in the government innovation strategy? How well is TPC positioned with respect to other initiatives within the Innovation Strategy? Is there overlap or duplication?

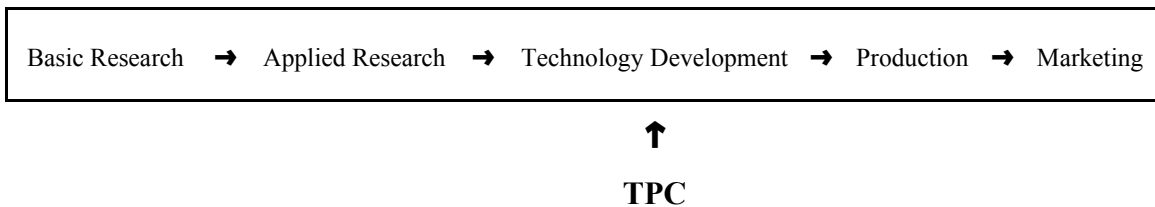
This question was addressed mainly through a review of key TPC internal documents and interviews with TPC, Industry Canada Sector Branch and IRAP personnel. The client survey and in-depth client interviews were used to identify any overlap or duplication with other programs.

Document and File Review

A number of TPC reports and business plans identified the role played by TPC and its positioning within the government innovation strategy. As stated in the most recent TPC Business Plan for 2002-2003, "...TPC was established to fill a gap in federal programming on the innovation continuum, and was designed to be complementary to

existing, related programs (i.e. NRC’s Industrial Research Assistance Program, regional development agencies, etc.). The gap filled by TPC, which was at the product development end of the innovation continuum, was impeding progress on jobs, growth and sustainable development. Documents show that other government programs and agencies, such as NSERC, NRC and government department research laboratories, support earlier stage R&D and some technology development. Except for IRAP, other government programs that support R&D and technology development are carried out in universities and government laboratories. TPC, IRAP and IRAP-TPC are the main government programs to support innovation projects carried out by private sector firms. As a result of the WTO ruling in 1998, TPC adjusted its positioning in the innovation continuum, moving away from direct support to commercialization towards the earlier stages of technology and pre-competitive development. Exhibit 1, which follows, shows the present position of TPC on the innovation continuum.

Exhibit 1: TPC Position in Innovation System



In some cases, TPC cooperates with other government departments in areas of complementary interest. For example, TPC’s Environmental Technologies Program and the Natural Resources Canada Climate Change Action Fund (CCAF) have similar objectives with respect to reduction of greenhouse gases (GHGs). In September, 1998, TPC signed an MOU with the Climate Change Secretariat of Natural Resources Canada that allocated \$15,000,000 to TPC over three years to fund projects that support the development and demonstration of technologies to reduce greenhouse gases.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Most of those interviewed who commented on this issue stated that TPC and IRAP-TPC are positioned closest to market of all government innovation programs. However, one TPC interviewee suggested that some TPC projects in the environmental and enabling technologies areas are at an earlier stage. One interviewee noted that the Business Development Corporation (BDC), which provides support closer to commercialization, also supports innovation. He noted that BDC had recently received \$200,000,000 to finance biotechnology firms.

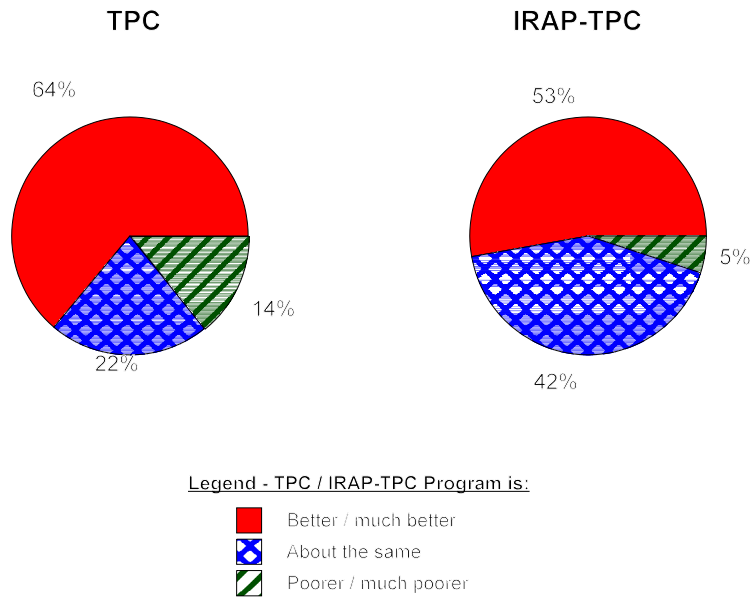
One interviewee said that the Atlantic Canada Opportunities Agency (ACOA) Atlantic Innovation initiative provides non-repayable grants to firms for similar projects as those funded by TPC. The other regional development agencies were considered to be doing much less in this business area.

Client Survey

TPC and IRAP-TPC clients surveyed were asked if they were aware of any programs or services of the federal or provincial government which were comparable or similar to the program. The majority of TPC (59%) and IRAP-TPC (75%) clients indicated that they were not aware of any. Of the few who were aware of comparable programs, the most frequently mentioned programs were IRAP (41%) for TPC clients and TPC (13%), other Industry Canada programs (13%) or provincial research institutes (13%) for IRAP-TPC clients.

Figure 1 which follows shows how clients rate the program against what they believe to be comparable programs. The figure shows that the majority of TPC and IRAP-TPC clients who identified comparable programs believe that the program is better than comparable ones. The most frequently cited reasons for TPC clients are that TPC has more money or better financial arrangements (19%), it funds larger or longer-term projects (15%), its focus is better (15%) and / or it has a better or clearer application and / or other processes (15%). On the other hand, frequently mentioned reasons for IRAP-TPC clients are that this component of the program has better or clearer processes (26%),

Figure 1: TPC / IRAP-TPC versus Others
 (Base: Respondents aware of other programs)



it has more money or better financial arrangements (21%), its focus is better (16%) and / or its staff is better (11%).³

In addition, clients were asked to identify in what ways the program was unique. The following were the responses mentioned most frequently by TPC clients:

- ▶ the repayment aspects of the program (32%);
- ▶ the large amounts of money it provides (24%); and,
- ▶ the support for research / technology / development (15%).

In addition, 10% were unable to identify any specific way in which TPC was unique. For IRAP-TPC, 20% of respondents could not identify any specific unique features. For IRAP-TPC, the most frequently mentioned unique features were:

- ▶ the focus on commercialization or pre-commercialization (18%); and,
- ▶ the support for research / technology / development (13%).

³ Given the small number of respondents saying that the program is poorer (i.e., 4 for TPC and 1 for IRAP-TPC, negative responses are not discussed.

All other responses were mentioned by fewer than 10% of respondents.

In-depth Client Interviews

The in-depth client interviews gave substantially the same types of responses as the client survey. In several cases, TPC clients identified IRAP as being similar to TPC. Others considered TPC to be unique among government programs in providing conditionally repayable loans (similar to taking an equity position) to large firms to support innovation.

Case Studies

Several of the case studies provided examples of TPC funding partnering with other government programs with complementary objectives to better achieve project success. For the MDS Aerospace Support Ltd project, TPC funding was partnered with support from the Canadian Commercial Corporation, that acted as prime contractor to help the firm win a contract with Rolls Royce. In the case of the Teleflex GFI project, TPC funding was supplemented by CCAF funding. In this case, government programs co-operated to provide a higher level of government support than TPC could provide on its own.

4.0 Progress in Delivering Program and Achieving Success

4.1 Evaluation Issues

Are TPC program objectives clearly understood by TPC managers and staff, stakeholders, clients and potential clients?

To what extent is TPC achieving stated program objectives? Were there significant contributing factors and impediments to TPC success?

Has the management of TPC achieved operational objectives related to administrative costs, percentage of project costs funded, and allocation of project funds between sectors (aerospace and defence, environmental and enabling technologies)?

To what extent have TPC funded projects achieved objectives identified in proposals and contribution agreements? Have technical and commercial success occurred? What have been the environmental impacts of TPC funded projects? What other impacts have occurred?

To what extent have the impacts of TPC funded projects extended beyond the funded firm to the larger industrial community?

To what extent have TPC funded projects led to long term job creation within the funded firms and beyond? What types of jobs have been created? To what extent has TPC helped develop highly skilled personnel for the Canadian innovative industrial community?

4.2 Detailed Findings

4.2.1 Are TPC program objectives clearly understood by TPC managers and staff, stakeholders, clients and potential clients?

Evidence to address this issue came primarily from the review of project files, and interviews with TPC, IRAP, Industry Canada Sector and OGD personnel. Evidence from the client survey also contributed to addressing the issue.

Document and File Review

Examination of the TPC website shows that it provides basic information about the program, its formal objectives, terms and conditions for each of the three elements, and what procedures to follow to apply for funding. TPC also has similar information available in printed form. In addition, TPC provides background reports to media for all

public announcements of TPC funding of projects. This information is easily available to all who seek it.

The recent market study of SMEs that have received IRAP-TPC assistance found that, while SMEs who are already clients understand program objectives, many firms that are potential clients are unaware of the program. In general, IRAP ITAs do not make firms aware of the program unless they consider the firm to be an appropriate candidate for IRAP-TPC assistance. The study also found that ITAs who have not had a IRAP-TPC project were less likely to promote the program. About 40% of ITAs surveyed reported that SMEs were “not much” aware of the program. Interviewees reported that a decision had been made early in the life of the program to limit promotion due to concern that demand would rapidly outstrip the resources available.

TPC project files and project management procedures were examined to determine to what extent they reflect the broad range of objectives of the program. Following selection of a project and signing of a contribution agreement, project management during the work phase focuses on ensuring that requests by the firm for payment of TPC’s share of the project are closely tied to the agreement. Information is also collected annually from the firm using the Annual Information Update (AIU) on the actual number of person years of work created or maintained, and additional firm expenditures leveraged by the TPC investment as a result of the project. Once the work phase is completed, data is collected on the actual level of sales and repayment of the TPC contribution.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Several TPC managers and staff interviewed commented that almost all firms in the aerospace sector are well acquainted with TPC objectives due to their long term relationship with government funding. However, they noted that, in the other sectors, potential clients are much less likely to be aware of TPC’s objectives, or of the availability of the program to meet their needs. Some interviewees commented that many other government departments involved in innovation are aware of TPC through participation by their staff on selection committees or review of proposals.

Several TPC interviewees commented that there is considerable tension within the program between TPC’s technical and commercial objectives. Some believe that technology development and building the firm’s technical capability are most important, and give less importance to the likelihood of commercial success and repayability. Others focus more on choosing projects with a high probability of commercial success that may be less innovative. This tension also exists between the three program areas. The Environmental and Enabling Technology program areas have few proposals from large

established firms with established product lines, making these projects inherently more risky. On the other hand, most proposals for the Aerospace and Defence program area come from established firms with established marketing and distribution links to customers, making these projects less risky from a commercial perspective.

Another interviewee noted that there is also some tension within TPC related to the positioning of projects on the R&D to commercialization spectrum. While the stated objective of TPC is to position the program as providing support after the R stage of innovation, one TPC interviewee expressed the opinion that TPC should support earlier stage R, because projects at the pre-commercialization stage can attract other financing from venture capitalists.

Another TPC interviewee noted that there are specific differences between the objectives of the Aerospace and Defence program area and the Environmental and Enabling Technologies program areas, as expressed in the Terms and Conditions. He also noted that the differences are almost invisible to most observers. For example, the wording for the Eligibility Criteria for Environmental Technologies is that the component “encourages and supports the development and application of innovative technologies that contribute to the achievement of sustainable development, or that have significant environmental benefits”. The Enabling Technologies eligibility criteria state that the component “encourages and supports the development, application and diffusion of those critical technologies that will have major impact and benefits within and across industry sectors”. The eligibility criteria for the Aerospace and Defence component of TPC state that the component “encourages and supports the development and application of technologies essential for the development of these sectors”.

Several interviewees noted that the initial selection is based primarily on the extent to which proposals address government objectives, with the achievement of the firm’s objectives an important but secondary factor. The Environmental Technologies component is most specific in that it supports innovative technologies related to sustainable development that provide environmental benefits. The Enabling Technologies component has broader yet more specific criteria in that they identify the need to support critical technologies that will have impact at the sector level. The Aerospace and Defence component criteria do not mention innovation specifically, but state that support is directed towards technologies essential to support the sector. It was noted that these distinctions become blurred in practice, with the linkages to government objectives being the primary criterion.

The Environmental Technologies component is focussed on the many aspects of sustainable development, and the Enabling Technologies component is focussed on critical technologies that can have major impact within or across sectors.

Several IRAP interviewees noted that not all IRAP ITAs are familiar with or comfortable with IRAP-TPC yet. There is also little evidence that IRAP has operational links with TPC, or directs SMEs with potential projects larger than \$1,500,000 to TPC.

Client Survey

There were two questions in the client survey that address this issue. The first is more directly relevant since it asks clients what they believe to be the objectives of the program. The second is more indirect in that it asks clients to what extent they believe other organizations are aware of the program.

In terms of the perceived objectives, the most frequently mentioned key objectives by TPC clients were:

- ▶ to do research and / or development, not specifying in Canada (38%);
- ▶ to create employment (33%);
- ▶ to do research and / or development in Canada (32%); and / or,
- ▶ to help Canada’s growth on the global market, to be more competitive internationally (25%).

Table 4 which follows shows that there are some interesting differences in the responses of clients, based on whether or not the project has completed the workphase (i.e., less recent vs. more recent clients) as well as according to the program areas.

Table 4: TPC Objectives by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
To do research and / or development	38%	44%	32%	36%	33%	40%
To create employment	33%	29%	36%	24%	25%	36%
To do research and / or development <u>in Canada</u>	32%	27%	36%	32%	33%	30%
To help Canada’s growth on the global market	25%	29%	21%	28%	33%	20%

The key responses given by IRAP-TPC clients were slightly different than those provided by TPC clients. The four key objectives identified by IRAP-TPC clients were:

- ▶ to take the product to the commercialization stage (48%);
- ▶ to do research and / or development in Canada (23%);
- ▶ to help Canada’s growth on the global market, to be more competitive internationally (14%); and / or,
- ▶ to create employment (12%).

Table 5, which follows, shows that there are some interesting differences in the proportion of clients providing some of these responses based on whether or not the project is completed (i.e., less recent vs. more recent clients) as well as according to the program areas.

Table 5: IRAP-TPC Objectives by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
To take the product to the commercialization stage	48%	58%	47%	20%	67%	47%
To do research and / or development <u>in Canada</u>	23%	25%	22%	20%	17%	25%
To help Canada’s growth on the global market, to be more competitive internationally	14%	8%	15%	20%	17%	14%
To create employment	12%	8%	12%	40%	0%	12%

In terms of their assessment of the level of awareness of other organizations of the program, neither TPC nor IRAP-TPC clients believe that others are well aware. On a scale of 1 (not at all aware) to 10 (fully aware), the survey responses are as presented in Table 6 below.

Table 6: Perceived Awareness of Other Organizations of the Program

	TPC	IRAP-TPC
Total	6.1	5.2
Project with workphase completed	6.4	5.5
Project with workphase not yet completed	5.7	5.2
Aerospace	6.1	4.5
Environmental technologies	5.9	5.6
Enabling technologies	6.1	5.3

Note: average awareness on a scale of 1 to 10

4.2.2 To what extent is TPC achieving stated program objectives? Were there significant contributing factors and impediments to TPC success?

In order to address this important issue, the objectives of TPC first need to be identified. Evidence to address this issue came from a variety of sources, primarily document and file review, TPC interviews, the client survey and case studies.

Document and File Review

The objectives of TPC are stated in several different ways. For example, on the TPC website, under the title What is TPC?, the following statement is found:

Technology Partnerships Canada (TPC) is a technology investment fund established to contribute to the achievement of Canada's objectives: increasing economic growth, creating jobs and wealth, and supporting sustainable development. TPC advances and supports government initiatives by investing strategically in research, development and innovation in order to encourage private sector investment, and so maintain and grow the technology base and technological capabilities of Canadian industry. TPC also encourages the development of small and medium sized enterprises (SMEs) in all regions of Canada.

The description goes on to state that:

Development of new technology is a high risk venture. TPC makes investments in projects that would not otherwise proceed within the desired scope, timing or location.

An alternative description of TPC's objectives, that relates more to project level objectives, is found in the section describing Assessment Criteria, which states:

Investment Outlines and Proposals are assessed in the context of their relevance to the objectives of TPC, namely the extent to which they demonstrate:

- ▶ *that the project contributes to the strategic objectives of the government, including technological and net economic benefits to Canada (increasing economic growth, creating jobs and wealth, and supporting sustainable development);*
- ▶ *that the project is technologically feasible, and that the applicant possesses, or can reasonably be expected to secure, the requisite technological and managerial capabilities and financial resources to achieve the stated objectives of the project;*
- ▶ *that a contribution under TPC is necessary to ensure that the project (either individually or as part of a portfolio of related activities of the applicant) proceeds with the desired scope, timing, or location; and*
- ▶ *that the contribution will be repaid.*

The 2001-2002 TPC Annual Report provides information about several aspects of objectives achievement, including job creation. For example, the 2001-2002 Annual Report states that, based on forecasts, more than 36,000 high quality jobs will be created or maintained during the life of the investments. The same Annual Report discusses how TPC encourages private sector investment. It notes that, based on project proposals, the private sector is forecast to invest over \$4 in R&D spending for every dollar of TPC funding. (The manner in which TPC calculates jobs and the reliability of forecasts will be discussed in Section 4.2.6). The 2000-2001 Annual Report discusses how TPC supports strategically important areas. The report states that “ TPC targets investments that address the government's environmental priorities of climate change sustainable development, pollution prevention and clean water. Pollution abatement and remediation technologies are also a focus”.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Most TPC interviewees considered that TPC is achieving stated program objectives to a considerable degree. Given that projects must be highly incremental to be funded, then the additional employment related to each project shows that the program is contributing to job growth in those sectors that are supported. There was a general sense that the program design and delivery was aligned with achievement of objectives.

One TPC manager commented that TPC in fact supports a number of government objectives, some of which are included in the formal statement of TPC objectives and the terms and conditions of the program, and others that are not. From his perspective, TPC support to the Aerospace and Defence sector is focussed on providing relatively long term, substantial support to maintain and grow within Canada this well established and internationally successful sector, through relatively low risk late stage development projects. Support to the environmental and enabling technologies areas is largely focussed on strategic support to selected projects in these relatively new and emerging sectors, through higher risk, often breakthrough projects. In addition to these two areas covered by TPC terms and conditions, the program is also used by the government when needed, as the vehicle to make important, strategic investments deemed to be important to major elements of the economy. Investments in the Inco Voisey's Bay initiative, helping the IBM Canada Toronto Software Laboratory win a major, multi-year, competitive contract and supporting Canadian aerospace firms working on the Joint Strike Fighter initiative are examples of funded projects that show how TPC is used to support strategic projects.

A number of interviewees from both TPC and IRAP commented that having the TPC funding as conditionally repayable was a very important factor in the success of the program. They found from experience that firms very much appreciate this aspect of the program design. From the perspective of a commercial lender, the fact that the TPC funding is a contingent liability means that it is quasi-equity, to be repaid only upon success, and does not negatively impact the ability of the firm to raise debt financing. Next to non-repayable funding, this is the best option for firms.

However, interviewees also identified a number of impediments that affected the achievement of objectives. Most involve program design and delivery issues, such as:

- ▶ administrative burden, causing delays in project approvals, and harming project administration and monitoring by TPC staff;
- ▶ the 3% cap on administrative expenses, affecting TPC's ability to effectively deliver and manage the program;

-
- ▶ loss of experienced staff in Industry Canada line branches, limiting availability of strategic intelligence and advice on project selection;
 - ▶ the inappropriateness of the procurement model for projects in the enabling and environmental sectors, and the lack of flexibility in project delivery; and,
 - ▶ cash flow and money management within the government fiscal year restraints, resulting from slower than planned expenditures due to economic downturns, requiring major adjustments in multi-year fiscal planning and large carry forward of committed funds.

These impediments will be discussed in some detail in Section 5 within the context of changes to design and delivery.

Client Survey

Objectives Achievement

As noted in the document and file review section, the following are the key objectives of TPC:

- ▶ to increase economic growth;
- ▶ to create jobs and wealth;
- ▶ to support sustainable development;
- ▶ to maintain and grow the technology base and technological capabilities of Canadian industry;
- ▶ to encourage the development of SMEs in all regions of Canada; and,
- ▶ to do so by making investments in projects that would not otherwise proceed within the desired scope, timing or location (i.e., to be incremental).

The success of the program in achieve each of these objectives is discussed below from the perspective of the client survey results. The results are presented in total and in terms of firms with projects that have completed the workphase and those that have not yet completed the workphase. As expected, the percentage of respondents with the workphase not completed that report these types of benefits is generally smaller than those with the workphase completed. While there may be some benefits during the project, these types of benefits occur fully only after the project workphase is completed.

To increase economic growth

The survey of clients measured increased economic growth through the incidence of increased firm revenues, profitability and / or competitiveness. Table 7 shows the results for TPC clients. The table shows that, not surprisingly, a large proportion of the clients expected these objectives to occur as a result of the project. In addition, the table shows that these objectives are more likely to have occurred in cases where the projects are completed. It is also noteworthy that the three factors related to economic growth objectives were reported more frequently in clients funded for environmental technologies projects.

Table 7: TPC Contribution to Economic Growth by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
<i>Increased revenues of firm</i>						
▶ Expected	91%	89%	93%	88%	100%	90%
▶ Occurred	33%	44%	23%	32%	46%	32%
<i>Increased profitability of firm</i>						
▶ Expected	88%	89%	86%	84%	85%	90%
▶ Occurred	26%	37%	14%	33%	46%	18%
<i>Increased competitiveness of firm</i>						
▶ Expected	89%	94%	84%	100%	100%	82%
▶ Occurred	68%	77%	56%	52%	92%	71%

Note: Occurred is based on only those expecting it to occur rather than total sample

Table 8 shows the results from the survey of IRAP-TPC clients.

Table 8: IRAP-TPC Contribution to Economic Growth by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
<i>Increased revenues of firm</i>						
▶ Expected	95%	92%	95%	100%	100%	94%
▶ Occurred	44%	82%	40%	40%	58%	42%
<i>Increased profitability of firm</i>						
▶ Expected	90%	92%	90%	100%	100%	89%

Table 8: IRAP-TPC Contribution to Economic Growth by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
► Occurred	29%	37%	29%	40%	42%	29%
<i>Increased competitiveness of firm</i>						
► Expected	94%	100%	93%	100%	92%	95%
► Occurred	69%	83%	67%	80%	73%	66%

Note: Occurred is based on only those expecting it to occur rather than total sample

To create jobs and wealth

In reporting on this aspect of the program, it is important to note that the results reported are based on information provided in the survey by the respondents and this information has not been verified. In addition, due to the formative nature of this evaluation, the survey only measured the incidence of the creation of new highly skilled jobs and overall long term job growth. The specific types of jobs and the redistribution of jobs was not examined.

Nonetheless, the survey results show that the program appears to have made some inroads in this regard. Table 9 summarizes some of the key results reported by the TPC clients surveyed whereas Table 10 summarizes some of the key results reported by IRAP-TPC clients surveyed. It is important to note the following about various components of the two tables:

- The high proportion of clients reporting the maintenance and/or creation of highly skilled jobs compared to the relatively low proportion reporting long term job creation is not surprising since highly skilled jobs are the direct result of the project whereas long term job growth will only be measurable once projects have been completed for some time. Since most projects have not yet completed the workphase, these results are to be expected.
- While the tables present average change in the number of skilled and total employees, it is important to note that the growth cannot be fully attributed to the program. Nonetheless, a significant proportion of clients reported that highly skilled jobs had been created as a result of the project and the average client reports actual growth. Similarly, a lower proportion of clients report long term job growth and the average clients reports actual growth in the number of full-time employees.

Table 9: TPC Contribution to Job Creation by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
Maintenance of existing highly skilled jobs						
▶ Expected	98%	96%	100%	100%	100%	96%
▶ Occurred	93%	96%	91%	92%	84%	96%
Creation of new highly skilled jobs						
▶ Expected	89%	91%	86%	92%	92%	86%
▶ Occurred	81%	83%	79%	74%	83%	84%
Number of employees in highly skilled jobs						
▶ before TPC	265	84	452	220	254	293
▶ now	341	166	521	440	353	306
▶ average change	+29%	+98%	+15%	+100%	+39%	+5%
Long term job growth						
▶ Expected	92%	91%	93%	92%	85%	94%
▶ Occurred	46%	55%	37%	39%	36%	51%
Number of full-time employees						
▶ before TPC	439	191	722	366	472	416
▶ now	515	293	761	542	642	424
▶ average change	+17%	+54%	+6%	+48%	+36.%	+2%

Note: Occurred is based on only those expecting it to occur rather than total sample

Table 10: IRAP-TPC Contribution to Job Creation by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
Maintenance of existing highly skilled jobs						
▶ Expected	93%	92%	93%	100%	75%	94%
▶ Occurred	91%	100%	90%	100%	89%	90%
Creation of new highly skilled jobs						
▶ Expected	90%	75%	92%	80%	92%	90%
▶ Occurred	82%	100%	80%	100%	73%	82%
Number of employees in highly skilled jobs						
▶ before IRAP-TPC	13.0	14.1	12.9	9.8	6.4	14.3
▶ now	14.7	24.6	13.7	22.8	9.4	15.1
▶ average change	+13.1%	+74.5%	+6.2%	+132.7%	+46.9%	+5.6%
Long term job growth						
▶ Expected	93%	75%	95%	100%	100%	92%
▶ Occurred	43%	67%	40%	40%	42%	42%
Number of full-time employees						
▶ before IRAP-TPC	16.3	16.8	16.3	12.4	15.5	17.1
▶ now	24.2	36.2	23.1	24.8	16.2	25.9
▶ average change	+48.5%	+115.5%	+41.7%	+100.0%	+4.5%	+51.5%

Note: Occurred is based on only those expecting it to occur rather than total sample

To support sustainable development

Amendments to the *Auditor General Act* define sustainable development as “... a continually evolving concept based on the integration of social, economic, and environmental concerns, ...”. In addition to the economic and job benefits reported above, the survey of clients specifically probed into the environmental impacts of the funded projects. In total, 27% of TPC surveyed clients and 30% of IRAP-TPC surveyed clients indicated that the project had achieved environmental impacts. This means that more than 1 in 4 clients reported environmental impacts. Some of the most frequently mentioned impacts include:

-
- ▶ reduced greenhouse gases (9% for TPC, 4% for IRAP);
 - ▶ energy savings (6% for TPC, 6% for IRAP);
 - ▶ reduced waste / improved waste management (4% for TPC, 8% for IRAP); and,
 - ▶ a more environmentally friendly product (4% for TPC, 4% for IRAP).

In total, 13 of the TPC and 12 of the IRAP-TPC survey interviews involved environmental technologies projects. Not surprisingly, a much smaller proportion of interviewees in these cases reported no environmental impacts (8% in both cases). The most frequently reported environmental impacts from TPC environmental technologies clients were:

- ▶ reduced greenhouse gases (46%);
- ▶ energy savings (39%);
- ▶ reduced waste / improved waste management (23%);
- ▶ reduced water use / other water-related impacts (15%); and,
- ▶ reduced pollution (15%).

The most frequently reported environmental impacts from IRAP-TPC environmental technologies clients were:

- ▶ reduced greenhouse gases (33%);
- ▶ reduced waste / improved waste management (25%);
- ▶ energy savings (17%);
- ▶ a more environmentally friendly product (17%); and,
- ▶ promotion / education of environmental solutions / practices (17%).

To maintain and grow the technology base and technological capabilities of Canadian industry

To address this issue, the survey asked respondents about results related to the development of new or improved technologies, improved technological capability of the firm, and diffusion or adoption of technology beyond the firm (through spin offs, adoption by other firms). Tables 11 and 12 summarize the survey results.

Table 11: TPC Contribution to Technology Base / Technological Capabilities by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
<i>Development of new or improved technologies</i>						
▶ Expected	97%	94%	100%	95%	100%	98%
▶ Occurred	93%	93%	93%	92%	85%	92%
<i>Improved technological capability of firm</i>						
▶ Expected	96%	98%	93%	96%	100%	94%
▶ Occurred	91%	91%	90%	92%	85%	94%
<i>Diffusion or adoption of technology beyond your firm</i>						
▶ Expected	30%	37%	23%	28%	46%	28%
▶ Occurred	47%	53%	36%	57%	33%	47%

Note: Occurred is based on only those expecting it to occur rather than total sample

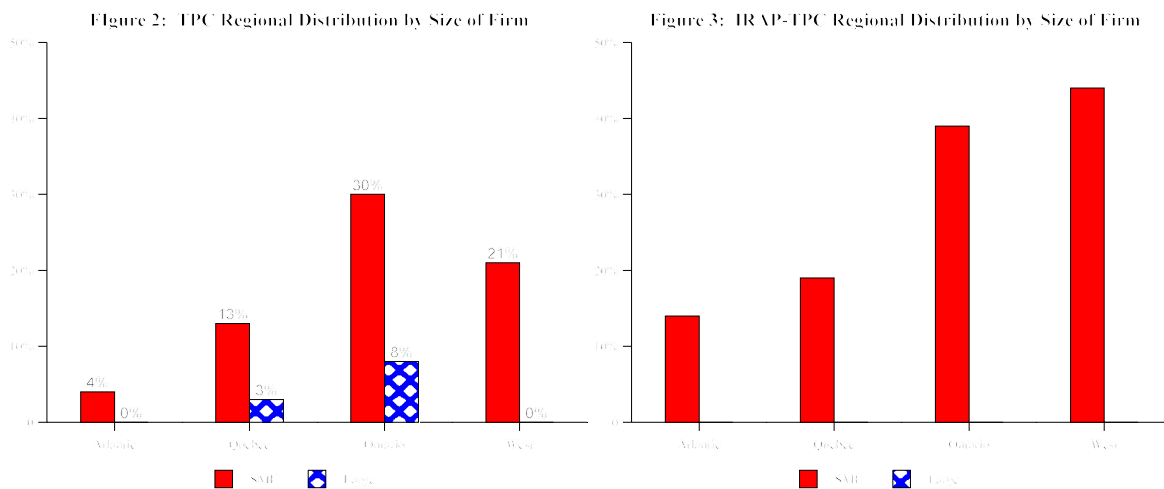
Table 12: IRAP-TPC Contribution to Technology Base / Technological Capabilities by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
<i>Development of new or improved technologies</i>						
▶ Expected	98%	92%	99%	100%	100%	97%
▶ Occurred	90%	100%	90%	100%	83%	90%
<i>Improved technological capability of firm</i>						
▶ Expected	98%	92%	98%	100%	100%	97%
▶ Occurred	90%	100%	89%	100%	83%	90%
<i>Diffusion or adoption of technology beyond your firm</i>						
▶ Expected	49%	42%	50%	40%	36%	51%
▶ Occurred	56%	60%	55%	100%	75%	53%

Note: Occurred is based on only those expecting it to occur rather than total sample

To encourage development of SMEs in all regions of Canada

While the survey did not address this directly, the profile information gathered on the size of the firms funded compared to the region of the organization provides a good overview regarding achievement of this objective. Figures 2 and 3 illustrates the number of SMEs and large firms by region for TPC and IRAP-TPC. The figures show that the large majority of TPC and all IRAP-TPC clients are SMEs. More precisely, 68 of the 79 TPC organizations (86%) who responded to the question on the number of employees were SMEs. In addition, the SMEs were spread throughout all regions of Canada.



To make investments in projects that would not otherwise proceed within the desired scope, timing or location (i.e. be incremental)

In the case of the client survey, project incrementality was measured by first asking the clients the impact of not receiving program funding for the project: major negative impact, minor negative impact or no impact at all. Once the magnitude of the impact was established, clients were then asked to explain exactly how the project would have been impacted. Since project incrementality is critical to being able to, at least partially, attribute the project results to the program funding, the survey results are examined in detail over the following several pages for TPC and IRAP-TPC.

In order to make comparisons, the survey responses were classified according to incrementality categories that have been used in previous evaluation studies as follows:

- ▶ **Full incrementality:** The project for which program funding was requested could not have occurred without the program funding and that would have had a major negative impact.
- ▶ **High incrementality:** The absence of program funding would have had a major negative impact on the project (e.g., reduced scope, delays, lost competitive advantage, etc.).
- ▶ **Low incrementality:** The absence of program funding would have had a minor negative impact on the project.
- ▶ **No incrementality:** The absence of program funding would not have had any impact on the project.

The overall survey results are presented in Table 13 below, comparing these to results obtained in other evaluation studies of innovation programs.⁴ The table shows that TPC and IRAP-TPC are in the low ranges for full incrementality (DIRP having the highest incrementality of all programs identified). However, TPC and IRAP-TPC also have the highest percentage of firms with high incrementality, and the lowest percentage with no incrementality (i.e., 0% in both cases – comparable only to DIRP).

Table 13: Project Incrementality

Program	Full	High	Low	None
TPC	24%	61%	15%	0%
IRAP-TPC	31%	58%	11%	0%
Defence Industry Research Program (DIRP – 1994)	62%	28%	10%	0%
IRAP (1995/96)	31%	37%	31%	1%
IRAP (1988/89)	24%	41%	34%	1%
IRAP (1984)	24-49%	45-69%		6-7%
Industrial Research Development Program (IRDP – 1989)	45-53%	36-47%		8-11%
Canadian Industrial Research Board (CIRB - 1986)	35-41%	55-59%		4-6%
Enterprise Development Program (EDP - 1983)	55%	39%		6%

Note: Ranges represent different program elements and / or recipients vs rejected applicants

⁴ Other programs include: Defence Industry Research Program (DIRP)

Tables 14 and 15 show the relative project incrementality for TPC and IRAP-TPC respondent firms for projects whose workphase is completed and not yet completed, by area of technology as well as by size of project contribution.

Table 14: TPC Project Incrementality

	Full	High	Low	None
Total	24%	61%	15%	0%
<i>Project Stage</i>				
Workphase completed	31%	51%	18%	0%
Workphase not yet completed	16%	72%	12%	0%
<i>Area of Technology</i>				
Aerospace	25%	63%	12%	0%
Environmental technologies	23%	69%	8%	0%
Enabling technologies	23%	61%	16%	0%
<i>Size of TPC Contribution</i>				
\$2 million or less	40%	43%	17%	0%
\$2 to \$5 million	18%	65%	17%	0%
more than \$5 million	14%	74%	12%	0%
<i>Total Size of Project</i>				
\$5 million or less	44%	39%	17%	0%
\$5 to \$25 million	26%	61%	13%	0%
more than \$25 million	4%	81%	15%	0%
<i>Proportion of TPC Contribution to Total Project</i>				
25% or less	17%	72%	11%	0%
25% to 30%	17%	59%	24%	0%
30% to 35%	23%	73%	4%	0%
more than 35%	42%	42%	16%	0%

Table 15: IRAP-TPC Project Incrementality

	Full	High	Low	None
Total	31%	58%	11%	0%
Project Stage				
Workphase completed	9%	73%	18%	0%
Workphase not yet completed	33%	57%	10%	0%
Area of Technology				
Aerospace	20%	80%	0%	0%
Environmental technologies	34%	58%	8%	0%
Enabling technologies	33%	56%	11%	0%
Size of IRAP-TPC Contribution				
\$250,000 or less	34%	52%	14%	0%
more than \$250,000	30%	61%	9%	0%
Total Size of Project				
\$1 million or less	33%	57%	10%	0%
\$1 to \$1.5 million	30%	60%	10%	0%
more than \$1.5 million	43%	43%	14%	0%
Proportion of IRAP-TPC Contribution to Total Project				
25% or less	40%	60%	0%	0%
25% to 30%	25%	33%	42%	0%
30% to 35%	33%	62%	6%	0%
more than 35%	0%	67%	33%	0%

In addressing incrementality, the survey also asked respondents to identify the specific ways in which projects would have been affected if program funding had not been available. TPC clients were most likely to mention the following:⁵

- ▶ the project would have been delayed (34%);
- ▶ the scope of the project would have been reduced (25%);

⁵ These are “top-of-mind” unprompted responses.

-
- ▶ the organization would not have proceeded with the project (24%);
 - ▶ the organization may not have proceeded with the project (13%); and,
 - ▶ the organization would not be as successful as it is today / it would have been negatively affected (11%).

IRAP-TPC clients were most likely to mention one or more of the following impacts:

- ▶ the project would have been delayed (33%);
- ▶ the organization would not have proceeded with the project (31%);
- ▶ the scope of the project would have been reduced (10%); and,
- ▶ it would have had an impact on employment / job loss (10%).

Key Impediments

TPC respondents were also asked what the program could have done differently to help make the project more successful. The highest proportion, 31%, indicated that the program could not have done anything differently, and 17% did not know. The most frequently mentioned responses by TPC clients who did have suggestions were to:

- ▶ speed up the process (18%);
- ▶ provide more money (11%);
- ▶ be more flexible (9%);
- ▶ provide funding for longer periods, have better terms for funding (7%);
- ▶ reduce the reporting requirements (6%); and,
- ▶ have better terms for repayment (6%).

Similarly, 31% of IRAP-TPC respondents said that nothing needed to change and 7% did not know. The most frequently mentioned responses in this case were:

- ▶ provide more money (16%);
- ▶ speed up the process (11%);
- ▶ provide more assistance, advice, expertise, on-going support (9%); and,
- ▶ have a more simple process (6%).

Case Studies

The projects examined in the case studies provide specific evidence of how projects contribute to the achievement of TPC technological and economic objectives, such as helping grow the technological base and technological capabilities of Canadian firms, creating and maintaining employment and achieving economic growth. These projects also demonstrate how TPC contributes to the achievement of government strategic

objectives through funding firm level projects. Each of the six projects examined resulted in significant improvements to the firm's technological capabilities, and competitive position.

In the case of IBM Canada, the project was both strategic and economic, as it made an important contribution to the securing of new investment, new employment and longer term security for the Toronto Software Development Laboratory, one of Canada's premier IT R&D performers.

In the cases of MDS Aero Support and Messier Dowty, the technological advances developed during the TPC projects were major factors in increasing the firms' visibility and reputation among its potential clients. Both of these organizations are now in much improved competitive positions vis-a- vis their peers from other countries.

The Teleflex GFI case study also provides an example of how projects contribute to the achievement of TPC objectives related to sustainable development and reduction of pollution, as well as technological and economic objectives. TPC funding has been an important factor in moving the firm into the position of being a major supplier of alternate fuel engine control systems to original equipment manufacturers, like Ford and General Motors, and positioning Canada as a supporter of the Kyoto Accord.

The two case studies of IRAP-TPC funded projects demonstrate the effectiveness of the program's support to SMEs, another objective of TPC. In one case, the project was technically successful, but not so commercially, due to a major change in the business environment that the project was designed for. This demonstrates the reality of this type of funding: while projects will not all be commercially successful, most should achieve project-level technical objectives.

Based on the limited evidence available from the six case studies, the most important factors impeding the successful achievement of TPC objectives of economic growth and long-term job creation are related to the downturn in the world economic environment and are outside the control of TPC or the Government of Canada. The only case where government support may have assisted is the Teleflex GFI project. In this case, continued support from the government in the form of subsidies for the use of alternate fuels, and increased regulation would have promoted the increased use of this technology, which is uneconomic as an alternative to gasoline at the present time. However, even in this case, the position of the U.S. government on the use of alternative fuels has the greatest influence on the commercial viability of the technology.

4.2.3 Has the management of TPC achieved operational objectives related to administrative costs, percentage of project costs funded, and allocation of project funds between sectors (aerospace and defence, environmental and enabling technologies)?

The primary source of evidence to address this issue was the TPC Annual Reports, with supporting evidence from other documents and data for 2002-2003 provided by TPC.

Document Review

Six annual reports have been produced for TPC, covering the period 1996-97 to 2001-2002. Data on each of these operational objectives was retrieved from these reports, and supplemented with estimates obtained from TPC for the current 2002-2003 year.

TPC’s operational objectives include having two thirds of funding going to the aerospace and defence sector and the remaining one third to the enabling and environmental sectors. Table 16 provides the actual allocation of contribution funds between aerospace and enabling and environmental programs for the seven year period since TPC began, on an annual and cumulative basis respectively. In 2001-02, TPC began to report enabling and environmental sector separately, and to include IRAP-TPC funding in the reported data. Unfortunately, this information is not available for previous years.

Table 16: Percentage of Total TPC Funding Allocations, by Sector¹

Year	Annual Allocation		Cumulative Allocation	
	Aerospace and Defence	Enabling and Environmental	Aerospace and Defence	Enabling and Environmental
1996-97 ²	87%	13%	87%	13%
1997-98	35%	65%	72%	28%
1998-99	55%	45%	68%	32%
1999-2000	29%	71%	56%	44%
2000-01	85%	15%	64%	36%
2001-02	36%	64%	59%	41%
2002-03	33%	67%	56%	44%

¹ excludes IRAP-TPC projects except for 2001-2002

² revised in 1997-98 report, to remove cancelled projects

As can be seen from Table 16, there has been a wide year-to-year variation in allocations between the three funded sectors. While TPC targets the Aerospace and Defence Sector to receive two-thirds of funding over the long term, the Aerospace and Defence Sector share of annual funding has ranged between a high of 87% in the first year, to a low of 29% in 1999-2000. The low in 1999-2000 is associated with the change in TPC program delivery caused by the WTO ruling that TPC funding to the regional aircraft industry could be considered in some cases a de facto export contingency. The high in the following year, 2000-2001 reflects a rebound from the previous hiatus in funding in this

sector. This high was followed by lows of 36% and 43% in 2001-02 and 2002-03 respectively.

The table also shows the cumulative total percentage of funding between the sectors. As can be seen, the percentage going to the aerospace and defence sector has dropped below 66% for the past four years, and correspondingly the percentage going towards enabling and environmental technologies has been above 33% for the same period.

One explanation for the recent reduction in funding going to aerospace and defence is that TPC may be choosing to change the ratio of funding between the sectors due to the heavy demand for support from firms seeking funding for projects involving enabling and environmental technologies. This possibility is supported by the 2002-2003 TPC Business Plan, that reports that TPC is reviewing the appropriateness of this ratio, and may seek Cabinet approval for rescinding the 2/3 to 1/3 expenditure rule.

Another TPC operational objective is to keep administrative costs as low as possible. The original objective was to keep costs at about 3% or lower. Table 17 shows TPC program management and administrative costs as a percentage of annual program funding for the period 1996-97 to 2002-2003.

Table 17: Management and Administrative Costs as % of Annual Program Funding

Year	TPC	IRAP-TPC
1996-97	3.4%	
1997-98	2.9%	
1998-99	2.8%	6.7%
1999-2000	2.8%	6.7%
2000-01	3.0%	7.2%
2001-02	3.4%	7.7%
2002-03*	3.8%	Not Available

* preliminary data

As shown in Table 17, the costs were higher than the target for the first, start-up year, then dropped for the next few years. However, the level has recently had an upward trend, rising from 2.8% of program costs in 1999-2000 to 3.8% in 2002-2003.

Costs of delivering IRAP-TPC are significantly higher, in the 7% range. This is due to a number of factors. Chief among them is the decentralized, more interactive and supportive delivery approach used by IRAP.

A comparison was also made of the costs of managing and delivering TPC to selected other government innovation funding programs. Both PRECARN and CANARIE are third-party delivery mechanisms used by Industry Canada that are in some ways similar to TPC. For example, PRECARN provides contributions to private sector firms to conduct R&D related to the development of applications for intelligent systems. While these programs are somewhat smaller than TPC, they are each allocated 10% of program funding for management and administration expenses. In fact, the most recent funding of \$100,000,000 for the CANARIE CA* net 4 allocated an additional 2% of total funding to communications and program promotion, for a total of 12%.

While not a formal objective, there was another internal agreement to keep administrative and program management expenses down by keeping TPC staff to a 50 full-time equivalent (FTE) limit. TPC's strategy was to supplement staff with a number of contract workers and consultants in order to achieve operational objectives. Like the 3% expense commitment, this was kept until recently, when TPC has planned substantial increases. In 2001-2002, TPC had 54 FTEs of employment, while the forecast for 2002-2003 is for 70 FTEs.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

A number of TPC managers and staff interviewed noted that, from their perspective, the achievement of operational objectives related to allocation of funds and maintaining the 3% cap on expenses was detrimental to the program, as it limits the effectiveness of the program. Several mentioned that TPC had recently had an organizational review, restructured and added a significant number of new positions, and expanded into additional offices. These were considered indicators that the 3% limit on administration was a major problem, that this operational objective was not appropriate and that TPC would be seeking permission for change. There were similar comments about the 2/3 allocation of TPC funding to the aerospace sector and the remaining 1/3 to enabling and environmental technologies projects.

Client Survey

While client satisfaction will be discussed in detail in Section 5, it is noteworthy that the service feature with the lowest level of satisfaction for TPC is the speed of decision making where the average client gave a satisfaction rating of 5.7 out of 10 (10 being fully

satisfied). IRAP-TPC clients gave speed of decision making an average rating of 7.1 out of 10. In addition, when asked for suggestions for improvements to the program, the single most frequently mentioned improvement for TPC clients was to speed up the decision making/approval process (30% of all TPC clients surveyed mentioned this “top-of-mind” versus only 13% for IRAP-TPC clients).

It is impossible to determine the extent to which the 3% limit on administration affects the speed of decision making. Nonetheless, the difference between TPC and IRAP-TPC client survey results and the difference in actual administrative expenditures between TPC and IRAP-TPC (IRAP’s is more than double TPC’s) indicate that it may have an impact on speed of decision making.

4.2.4 To what extent have TPC funded projects achieved objectives identified in proposals and contribution agreements? Have technical and commercial success occurred? What have been the environmental impacts of TPC funded projects? What other impacts have occurred?

This is an important issue that was examined at length using several methodological approaches. These included a review of a sample of project files, interviews with TPC and IRAP staff, client surveys, in-depth client interviews and case studies.

Document Review

Approximately a dozen TPC project files were examined as part of the review of TPC program delivery, case studies and in-depth client interviews. The focus in each proposal was on the carrying out and completion of a technical project, that, in most cases, involved development of a product. In all the cases examined, projects achieved technical objectives. Review of the Annual Information Updates (AIUs) provided by the firm for each funded project showed that some projects took longer to complete the work phase than originally planned. In most cases, the number of person years of employment during the work phase of the project exceeded the forecast levels.

However, in all cases, projects did not achieve the commercial success and sales that were forecast in the proposals and contribution agreements. This is confirmed by two indicators, the royalties based on sales paid by the firms to TPC and the actual number of person years of employment during the post work or benefits phase, compared to the forecast levels. (The number and type of person years of employment will be examined in greater detail in Section 4.3.6.)

Several reasons were cited by firms in the AIUs for the lack of commercial success. These depended on the sector, but in general the high tech / .com / IT / aerospace / stock

market downturn of recent years occurred just as many of the projects completed the work phase. This has severely affected the demand for the new products.

The most recent TPC Annual Report for 2001-2002 noted that, of 173 projects that TPC has funded (not including IRAP projects) since 1996, six have been voluntarily withdrawn, and seven have been unsuccessful. Two other projects were terminated due to company takeover. This is less than 9% of projects. Most of these projects were smaller than average, and the reduction in forecast jobs was much less than 9%. In the case of the withdrawn and terminated projects, little TPC funding had been advanced, so the cost to TPC was much less than 1% of total funds disbursed.

The most recent TPC Annual Report did not provide any information on forecast and actual data for jobs or repayments, nor separate information for projects in the work phase or repayments phase. Reports have typically provided a very general overview of the situation, with little detail. The issue of public reporting on TPC performance measures is discussed in more detail in Section 5.3.10.

IRAP-TPC projects are typically much shorter in duration than TPC projects, and IRAP does not collect regular reports on the work phase of projects or the benefits resulting from funded projects.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

One TPC interviewee commented that from a technical perspective, “most projects are completed mostly successfully”. This summarizes the general feeling of interviewees. It was pointed out that project proposals are reviewed carefully for technical feasibility and the ability of the firm to provide financing and manage the project successfully. Consequently, most projects complete the work phase and achieve a high degree of technical success. Commercial success has been harder to achieve, due partially to the high risk nature of the projects and partially due to the dot com crash, the poor sales in the aerospace industry and the general economic downturn.

Several TPC interviewees commented that it is important to remember that TPC is mandated to fund high risk projects that would not proceed without TPC support. It was reported that, as part of the portfolio risk management procedures, TPC rates the overall risk of the project meeting the forecast level of commercial success in five categories (low, low-medium, medium, medium-high and high). These terms are defined to mean that TPC expects to recover the following percentages of forecast repayments:

- ▶ for the portfolio of low risk projects, between 80% and 100%;

- ▶ for the portfolio of low to medium projects, between 60% and 80%;
- ▶ for the portfolio of medium risk projects, between 40% and 60%;
- ▶ for the portfolio of medium to high risk projects, between 20% and 40%; and,
- ▶ for the portfolio of high risk projects, between 0% and 20%.

Due to the level of risk, a number of projects will not be successful, and will not achieve forecast levels of new and maintained jobs and sales. Similarly, a number of projects will not return forecast repayments. For the overall portfolio, the program expects to recover, in the long run, about half of TPC contributions in the form of repayments. It was also noted that, while this information is available in TPC internal documents, it is not discussed in the Annual Report or other public communications.

Several interviewees noted that, in the first few years, TPC did not collect sufficient information from firms to determine how successful projects were. Beginning with the 2000 calendar year, TPC instituted the use of an Annual Information Update to be filled out by all firms to collect information on several key aspects of projects, including person years of employment created and / or maintained during the work and benefit phase of the project, sustainable development benefits and repayments.

Several TPC and Industry Canada interviewees stated that the forecast jobs and sales for the benefits phase of projects are often very optimistic, and could only be achieved if economic, marketing and competitive conditions were optimal. In practice, this occurs infrequently. It was also pointed out that TPC discounts these forecasts internally for program management purposes.

Client Survey

While some of the actual and expected impacts of TPC and IRAP-TPC projects were delineated in Section 4.2.2, they are more fully discussed in this section. Table 18, which follows, highlights the reported impacts of TPC projects, in order of most frequently reported actual impacts (for total sample).

Table 18: TPC Impacts by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
<i>Maintenance of existing highly skilled jobs</i>						
▶ Expected	98%	96	100	100	100	96
▶ Occurred	93%	96	91	92	84	96

Table 18: TPC Impacts by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
<i>Development of new or improved technologies</i>						
▶ Expected	97%	94	100	100	100	94
▶ Occurred	93%	93	93	96	85	94
<i>Development of plans or designs for new or improved products, processes, services or applications</i>						
▶ Expected	88%	82	93	96	77	86
▶ Occurred	92%	95	90	92	90	93
<i>Development of new firm capabilities</i>						
▶ Expected	98%	98	98	96	100	98
▶ Occurred	91%	89	93	92	85	92
<i>Improved technological capability of firm</i>						
▶ Expected	96%	98%	93%	96%	100%	94%
▶ Occurred	91%	91%	90%	92%	85%	94%
<i>Development of new products, processes, services or applications</i>						
▶ Expected	94%	94%	96%	96%	100%	92%
▶ Occurred	82%	86%	79%	83%	85%	83%
<i>Creation of new highly skilled jobs</i>						
▶ Expected	89%	91%	86%	92%	92%	86%
▶ Occurred	81%	83%	79%	74%	83%	84%
<i>Increased competitiveness of firm</i>						
▶ Expected	89%	94%	84%	100%	100%	82%
▶ Occurred	68%	77%	56%	52%	92%	71%
<i>Diffusion or adoption of technology beyond your firm (through spin offs, adoption by other firms)</i>						
▶ Expected	30%	37%	23%	28%	46%	28%
▶ Occurred	47%	53%	36%	57%	33%	47%
<i>Long term job growth</i>						
▶ Expected	92%	91%	93%	92%	85%	94%

Table 18: TPC Impacts by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
► Occurred	46%	55%	37%	39%	36%	51%
<i>Increased revenues of firm</i>						
► Expected	91%	89%	93%	88%	100%	90%
► Occurred	33%	44%	23%	32%	46%	32%
<i>Increased profitability of firm</i>						
► Expected	88%	89%	86%	84%	85%	90%
► Occurred	26%	37%	14%	33%	46%	18%

Note: Occurred is based on only those expecting it to occur rather than total sample

TPC clients were also asked to report on the technical success of the project. The survey results show that the majority of TPC clients believed their project to be fairly successful in this regard (81% giving a rating of 8, 9 or 10 on a scale of 1 to 10). In fact, the average rating for TPC clients was 8.2 out of 10. Reasons provided for the high ratings included:

- the objectives were achieved or exceeded (29%);
- the technology is successful / proved the technology worked (25%);
- first in the world, recognized as leading edge (9%);
- it has resulted in sales, demand, positive market response (8%); and,
- ended up with a product or technology (7%).

In terms of the business or commercial success of the project, overall ratings were somewhat lower. Of the clients surveyed, 58% gave this a rating of 8 or more and the average rating was 7.0 out of 10. Reasons provided for high ratings were that the project had results in a commercial or soon to be commercial product (12%), that the objectives were achieved (10%), or that the business was now more successful or stronger (10%). On the other hand, the key reason given for low ratings was that market conditions were not good and sales were delayed (17%).

As mentioned in Section 4.2.2, 27% of TPC clients interviewed identified environmental impacts from funded projects.

TPC clients were also asked to identify other benefits. In total, 36% stated that there were none. A number of respondents identified the following benefits:

- ▶ increased visibility (25%); and,
- ▶ improved credibility (12%).

The great majority (71%) of TPC clients surveyed noted that there were no negative impacts to their firm resulting from the project and / or program assistance. However, two negative impacts were mentioned by several:

- ▶ the administrative burden or other frustrations in dealing with the program (14%); and,
- ▶ negative financial implications (11%).

Table 19 shows the actual impacts of IRAP-TPC projects based on those expected.

Table 19: IRAP-TPC Impacts by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
<i>Maintenance of existing highly skilled jobs</i>						
▶ Expected	93%	92	93	100	75	94
▶ Occurred	91%	100	90	100	89	90
<i>Development of new or improved technologies</i>						
▶ Expected	98%	92	99	100	100	98
▶ Occurred	90%	100	90	100	75	92
<i>Improved technological capability of firm</i>						
▶ Expected	98%	92	98	100	100	97
▶ Occurred	90%	100	89	100	83	90
<i>Development of new firm capabilities</i>						
▶ Expected	97%	92	97	100	100	97
▶ Occurred	90%	100	89	100	83	90
<i>Development of plans or designs for new or improved products, processes, services or applications</i>						
▶ Expected	93%	83	94	80	83	94
▶ Occurred	84%	90	83	100	80	84
<i>Development of new products, processes, services or applications</i>						
▶ Expected	93%	94	96	80	100	92

Table 19: IRAP-TPC Impacts by Project Stage and Client Type

Objective	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
► Occurred	83%	86	79	100	83	83
<i>Creation of new highly skilled jobs</i>						
► Expected	90%	75	92	80	92	90
► Occurred	82%	100	80	100	73	82
<i>Increased competitiveness of firm</i>						
► Expected	94%	100	93	100	92	95
► Occurred	69%	83	67	80	73	66
<i>Diffusion or adoption of technology beyond your firm (through spin offs, adoption by other firms)</i>						
► Expected	49%	42	50	40	36	51
► Occurred	56%	60	55	100	75	53
<i>Increased revenues of firm</i>						
► Expected	95%	92	95	100	100	94
► Occurred	44%	82	40	40	58	42
<i>Long term job growth</i>						
► Expected	93%	75	95	100	100	92
► Occurred	43%	67	40	40	42	42
<i>Increased profitability of firm</i>						
► Expected	90%	92	90	100	100	89
► Occurred	29%	37	29	40	42	29

Note: Occurred is based on only those expecting it to occur rather than total sample

From a technical perspective, the majority of IRAP-TPC clients rated the projects as successful. That is, 82% rated the project as an 8 or more out of 10 (extremely successful) and the average rating was 8.5. The three key reasons given for deeming the project technically successful were:

- the objectives were achieved or exceeded (28%);
- the technology was proven (20%); and,

- ▶ the project resulted in a new product or technology (15%).

From a commercial perspective, IRAP-TPC clients were somewhat less positive. Less than two-thirds (60%) gave the project a rating of 8 or more for business success; the average rating was 7.4 out of 10. Reasons given for deeming the project commercially successful included:

- ▶ ended up with a commercial or soon to be commercial product (20%); and,
- ▶ have satisfied clients, new customer, customer demand (15%).

As for TPC clients, IRAP-TPC clients who believed the project was not successful from a business perspective were most likely to identify poor market conditions as the key reason (11%).

About 30% of IRAP-TPC clients identified environmental impacts resulting from their project. The two key environment impacts noted were reduced waste or improved waste management (8%) and reduced water use or other water-related impacts (6%).

In terms of other benefits, a wide range were identified by 63% of IRAP-TPC respondents. The most frequently mentioned benefits were:

- ▶ increased visibility (17%);
- ▶ improved credibility (15%); and,
- ▶ other internal organizational benefits (11%).

When asked about negative impacts, the great majority (79%) said there were none. The only one noted by several respondents were negative financial implications (10%).

Case Studies

Some of the evidence presented in Section 4.3.2 is applicable to this issue as well. Based on information in project progress reports and discussions with firm personnel, each of the four TPC funded projects had more person years of employment than forecast, and achieved all or most of the technical project work phase objectives in the Contribution Agreements. Firm representatives interviewed agreed that each project has achieved technical success and a considerable level of commercial success, in that the firms are each in a much stronger competitive position than before the project. However, none of the four projects have achieved the forecast level of revenues, sales, person years of employment or repayments scheduled. In some cases, there is still the expectation that repayments will be made during the benefits phase, but later than forecast.

Two of the case studies provide examples of the types of environmental benefits that can result from projects in the Environmental Technologies area. In one project, Teleflex GFI received TPC support for development of a next generation alternative fuel engine control system for automobiles. This system enables the use of propane or natural gas instead of gasoline to power automobiles. Automobiles using this system and alternative fuels produce significantly less greenhouse gases and other pollution than gasoline powered vehicles. While most of the vehicles using this system will operate outside Canada, and not contribute directly to meeting Canada's Kyoto commitment, this successful project positions Teleflex GFI and Canada as significant contributors to sustainable development and improving the environment.

In the other case, IRAP-TPC has funded MetTech, a small start-up firm, to develop and demonstrate a process for the recovery of high purity gallium (Ga) from gallium arsenide (Ga As) waste material. In the production of Ga As semiconductor chips, there is considerable leftover material that needs to be recycled. MetTech has developed an innovative process to produce high purity Ga from the waste material. MetTech is the only Canadian firm in this business. This is an example of support for commercially viable recycling, and improved treatment of waste materials.

4.2.5 To what extent have the impacts of TPC funded projects extended beyond the funded firm to the larger industrial community?

The methodological approaches used provided only limited evidence of impacts beyond the funded firm. Document and file review and TPC interviewees provided minimal information, while the client survey and case studies provided only somewhat more.

Document and File Review

There was limited evidence from the document review about the benefits of the project beyond the firm. In a few of the project proposals and related documents examined, there was discussion of the benefit of the project to specific suppliers in regions of Canada, or comments that a high percentage of suppliers to a firm were Canadian.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Interviewees did not identify benefits beyond the funded firm, except to say that suppliers to firms with funded projects benefit as the firm becomes more successful. TPC does not capture information on sector level benefits.

Client Survey

The survey asked TPC and IRAP-TPC clients what other parties benefited from the funded projects and how these parties benefited. For TPC, only 8% said there were none and 12% did not know. Some of the key responses provided were:

- ▶ suppliers, subcontractors, consultants (34%);
- ▶ private sector organizations or specific industry sectors (18%); and,
- ▶ customers (16%).

The identified benefits to these parties included:

- ▶ increased business (49%);
- ▶ new or improved technology, product, service, process (34%);
- ▶ job or employment benefits (27%);
- ▶ increased efficiency, reduced costs, savings (16%);
- ▶ training, new skills, knowledge gained (12%); and,
- ▶ funded or supported R&D (10%).

On the other hand, a larger proportion of IRAP-TPC clients (27%) stated that no other party had benefited; in addition 3% did not know. The frequently mentioned parties were the same, that is:

- ▶ suppliers, subcontractors, consultants (23%);
- ▶ private sector organizations or specific industry sectors (23%); and,
- ▶ customers (19%).

Similar to TPC client responses, IRAP-TPC clients noted that these parties benefited as follows:

- ▶ increased business (53%);
- ▶ new or improved technology, product, service, process (33%);
- ▶ increased efficiency, reduced costs, savings (21%);
- ▶ training, new skills, knowledge gained (19%); and,
- ▶ job or employment benefits (11%).

Case Studies

While the case studies were expected to provide an opportunity to examine in detail the extended impact of TPC funded projects, there were only a few indications of the types of impacts that occur beyond the funded firm. In most cases, the identified impacts were in firms providing supplies and services to the funded firm. When firms funded by TPC do well, so do these other firms. For the Teleflex GFI project, the project summary

identified that, at the time of the proposal in 1997, 75% of firm suppliers were Canadian based. This is a reminder that all firms purchase capital equipment, components and materials, in many cases, from other Canadian supplier firms. The IBM Canada case study provides another example of how TPC funding has impacts beyond the firm level. At the time of the funding application in 1998, the Toronto Software Laboratory provided work for some 200 locally contracted software developers, as well as a number of small and medium sized establishments. In addition, the IBM Centre for Advanced Studies attached to the Toronto facility works with Canadian and foreign university researchers in knowledge creation linked to advanced software research and development. The TPC funding was also conditional on IBM Canada constructing a new integrated R&D facility which cost \$150,000,000. Much of the construction of this facility and capital equipment purchase came from Canadian firms, creating or maintaining secondary employment.

The other firms that benefit from TPC funding are those that purchase the products of the funded firm. In all six of the projects examined, the major target client groups are outside Canada. Certainly for aircraft component and jet engine testing equipment suppliers like Messier Dowty and MDS Aero Support, this is true, although Messier Dowty has supplied landing gear to Canadair / Bombardier aircraft production in the past. Most IBM Canada sales are worldwide as well, although Canadian firms, such as Sears and Rogers who are IBM clients, will benefit from the software developed during that project.

4.2.6 To what extent have TPC funded projects led to long term job creation within the funded firms and beyond? What types of jobs have been created? To what extent has TPC helped develop highly skilled personnel for the Canadian innovative industrial community?

The issue has been examined from a number of perspectives, however the first question that needs to be addressed is what constitutes a long term job in a real project? TPC follows Industry Canada guidance and reports on jobs rather than person years of employment. (Footnote: TPC includes only jobs directly related to the project within the funded firm and in subcontractors involved in the workphase of the project. TPC does not include indirect jobs in supplier firms or other multiplier effects). Job counts, while simple in theory, are difficult to calculate in practice. As well, the formula for calculating jobs is somewhat artificial. The approach used by TPC is discussed under the Document and File Review Section below.

A second issue is related to the quality of information captured by TPC. As mentioned elsewhere, TPC introduced an Annual Information Update in 2000, that funded firms were to complete and return. In a number of cases examined, particularly in early projects, the firms were unclear about how to complete the forms and in some instances provided incorrect information. In some cases examined, the incorrect information had

not been noticed and corrected. In these cases, the forecast jobs were incorrectly high. No detailed analysis of the effect of these incorrect data on total forecast jobs was undertaken; however, it is estimated that the effect is relatively small, probably less than 5%.

TPC provided data on forecast and actual jobs created or maintained as a result of the TPC funded projects, based on the formula used for jobs. This is reported in the Database Analysis Section below. The client survey and case studies also provided information on jobs.

Document and File Review

A review of TPC files shows that the TPC project model assumes two types of jobs. These are work phase jobs and benefits phase jobs. The model presumes that the person years of employment or jobs are directly due to the project, during the development (work) phase or the post development (benefits) phase. Work phase jobs last for the duration of the work phase, typically three to four years, and benefits phase jobs last for the duration of the benefits phase, typically five to eight years, but in some cases, over 10 years. Therefore, a typical work phase job is equal to three to four person years of work, and a benefits phase job is equivalent to five to eight person years of work. For the purposes of the calculation, it does not matter whether the work is done by one or ten people.

As mentioned in Section 4.3.4, based on the dozen or so project files reviewed in detail, the number of jobs actually created during the work phase was higher than originally forecast, and the number of jobs actually created during the early stages of the benefits phase has been lower than forecast. The model does not include those jobs created as a result of general improvements in firm technological capabilities that lead to sales of other products or services not directly linked to the project.

Database Analysis

TPC was asked to provide information addressing this issue. Data on actual and projected jobs was gathered for those projects that had completed the work phase and were in the benefits phase, as of December 31, 2001. Table 20 provides a summary of that information.

Table 20: Actual Jobs Created Compared to Forecast Jobs *

Project Phase	Aerospace & Defence	Enabling	Environmental	Total
Work Phase (data to December 31, 2001)				
Original forecast	2,919.9	491.6	393.5	3,805.0
Actual	3,395.9	668.9	395.4	4,460.2
Benefits Phase (data to December 31, 2001)				
Original forecast	1,284.7	261.2	159.1	1,705.0
Actual	1,038.5	51.6	32.1	1,122.2
All Phases (data to December 31, 2001)				
Original forecast	4,204.6	752.8	552.6	5,510.0
Actual	4,434.4	720.5	427.5	5,582.4
Number of projects	32	13	9	54

(the actual data is considered reliable, as it is based on actual data reported by firms)

*As mentioned previously, due to the method of calculating jobs, a “job” during the work phase is less long term or permanent than one during the benefits phase. A benefits phase job is defined as one person working throughout the work phase. If the work phase is three years, then a “work phase job” is defined as three person years of work. The benefits phase is typically at least twice as long as the work phase. A “benefits phase job” is defined as one person working throughout the benefits phase. If the benefits phase is six years long, one benefits phase job is defined as six person years of work during the benefits phase. In this example, a “benefits phase job” represents twice the number of person years of work as a “work phase job”. The appropriateness of using calculated jobs as a performance indicator will be discussed in Section 5.

As can be seen, actual jobs (and person years of work) are higher than forecast during the work phase and lower during the benefits phase. This is consistent with the evidence from the limited file review and case studies.

TPC management also provided data on the breakdown between types of jobs for projects in each of the three sectors. In the work phase TPC has three categories of employment: knowledge-based (scientist / engineer / technician), subcontractor, and management / administration. In the benefits phase, TPC uses categories of knowledge-based, production, and management, administration, marketing, sales and support (MAMASS). The TPC data is shown in Table 21, using these categories.

Table 21: Distribution of Projected Jobs by Type and Sector (as of January, 2003)

Type of Skills	Aerospace & Defence	Enabling	Environmental	Total
Work Phase				
Knowledge-based	5,088	1,993	1,242	8,323
Subcontractors	312	613	157	1,082
Management and administration	926	302	240	1,468
Work phase total	6,326	2,907	1,639	10,872
Benefits Phase				
Knowledge-based	2,985	2,443	2,701	8,129
General production	5,628	3,730	3,968	13,326
MAMASS	1,923	1,751	3,968	4,823
Benefits phase total	10,536	7,924	7,818	26,278
Total all phases	16,823	10,831	9,457	37,150
Number of projects	84	50	34	168

* numbers are estimates, based on forecast number of jobs as contained in contribution agreements

Care has to be taken in reading too much into these numbers as they are not actual jobs in most cases, but rather estimates. As has been shown earlier, some of the projections, particularly of benefits phase jobs may be significantly higher than the actual jobs created or maintained. The table shows that, on the basis of this data, the aerospace and defence sector has a larger fraction of jobs in the general production category during the benefits phase than the other sectors, although the knowledge based jobs are still substantial.

There is no data on turnover and leakage of highly skilled workers from these projects to other firms or other sectors.

Client Surveys

As previously discussed, 92% of TPC and 93% of IRAP-TPC clients expected long term job growth as a result of the project for which they received program funding. While this has not yet occurred in most cases (has occurred – 46% for TPC and 43% for IRAP-TPC), it is anticipated by most clients that it will occur in the future (46% for TPC and IRAP-TPC). In fact, in cases where the work phase is now completed (where one would

expect “long term” growth to be more likely), 55% of those expecting long term growth report that it has occurred whereas only 37% of those whose work phase is not yet completed report that it has occurred.

Case Studies

The IBM case study provides an example of how large an effect TPC support can have. At the start of the project in November, 1998, IBM had approximately 1,300 employees associated with the Toronto Software Laboratory, and by fall 2002, there were more than 1,800 employees. The TPC funded project is credited with being directly responsible for 250 to 300 of those jobs, and indirectly responsible for the rest.

It is not possible to state with certainty that IBM Canada would not have won the competition without TPC support, but TPC staff reported that IBM representatives said that the funding was directly responsible for the long term survival and growth of the Toronto laboratory.

In several of the other projects examined, the actual number of long term jobs that the firms state have been created or maintained during the benefits phase is significantly less than forecast. This has been generally due to the economic downturn in most sectors, including aerospace, IT and other “high tech” supported areas. It is also true that several of the other firms would have had fewer employees than they now have if the TPC funded project had not occurred.

One of IRAP-TPC funded case studies provides an example of a technical success and commercial failure, that resulted in no long term jobs being created. This was the result of an extreme change in market conditions that made the product no longer viable.

All projects have some degree of commercial risk that parallels the likelihood of long term job creation or maintenance. High risk projects are, on average, more likely to fail, and less likely to lead to the creation of jobs.

5.0 Program Design and Delivery

5.1 Research Questions

How satisfied are applicants and funded firms with program delivery (application, payment process, reporting requirements)? What suggestions do they have for change and improvement?

To what extent are project funding decisions consistent with program terms and conditions?

Who are the beneficiaries of the program? What is the profile of funded firms? To what extent is TPC reaching the intended target firms, including SMEs? How have co-delivery agents benefited from working with TPC?

To what extent has TPC formed effective partnerships with other program delivery organizations? In what manner have these partnerships helped TPC better deliver the program and achieve objectives? How has working with TPC helped partners?

Is TPC being delivered in an efficient and effective manner?

Are there changes to the design and delivery of TPC that could better deliver the program and / or achieve objectives?

What impact has the SOA status and structure had on TPC's ability to deliver the program, and achieve program objectives?

Is the SOA structure the most appropriate for TPC? Are there changes to the SOA authorities that can improve program delivery and achievement of success?

Are the responsibilities for management and delivery of the program and achievement of success clearly defined between Industry Canada, TPC and the Advisory Groups?

Does TPC have an operational Performance Measurement and Reporting System, that is used for program management, and that provides information required for annual performance reporting and periodic in-depth evaluation studies?

5.2 *Detailed Findings*

5.2.1 **How satisfied are applicants and funded firms with program delivery (application, payment process, reporting requirements)? What suggestions do they have for change and improvement?**

To provide context to the discussion on this issue, it is important to note that recently, TPC developed a more formal and specific reporting approach, known as the Annual Information Update (AIU). Beginning with the 2001 year, firms with funded projects were required to provide annually updated information on a number of items, including:

- ▶ forecasts of future repayments;
- ▶ actual person years of employment by category created or maintained as a result of the project for the previous year, and forecasts of person years of employment for future years until the end of the benefits phase;
- ▶ expected project results (patents, acquisition of technology, corporate mandates, other significant results);
- ▶ investment leverage (all costs or expenditures incurred in Canada that may be (forecast) or have been (actual) leveraged by TPC funding of the firm project; and,
- ▶ sustainable development benefits.

For the 2002 year, the form requesting information on person years of employment was changed.

From an evaluation methodology perspective, the client survey is the key source of information for this issue. Since the client survey sample size was increased, unsuccessful applicants were not surveyed. As such, this issue only deals with the satisfaction of funded firms.

Document and File Review

The recent market study of SMEs that have received IRAP-TPC assistance provides information on satisfaction of SMEs that have received funding. Firms surveyed reported that they were most satisfied with:

-
- ▶ the level of personal interaction with the ITA;
 - ▶ reporting requirements on project results and benefits;
 - ▶ eligibility criteria; and,
 - ▶ their opportunity to present and defend the project.

They were least satisfied with:

- ▶ the proportion of eligible costs supported; and,
- ▶ the maximum amount of project costs eligible.

A number of firms surveyed were also dissatisfied with the policy of attaching repayments to the overall firm revenue stream, rather than the revenues from the funded project. The length of time for approval of projects was also unsatisfactory for a number of firms.

There was very little information in the project files examined related to the satisfaction of funded firms with program delivery. There were one or two letters or notes to file for projects funded in the first few years of the program related to confusion by the firm over the new reporting requirements, and the ability of the firm to provide the required information.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Government interviewees had a number of comments on this issue. Some interviewees did say that larger firms and those that had been familiar with DIPP or had received earlier funding from TPC were most likely to be satisfied with TPC processes. Firms unfamiliar with government processes were considered most likely to have problems with the approach. A number of interviewees from TPC and Industry Canada commented on the confusion that resulted when companies were first required to complete the AIU forms. Interviewees also identified problems in relationships with firms when Program and Policy Management Branch (PPM) of Industry Canada was brought in to manage the benefits phase of projects. In some cases, firms were not informed of the changeover from working with the TPC project officer to the PPM project officer. The addition of the PPM Branch to TPC program delivery partners also resulted in a greater focus on repayments. It was reported that in some respects they were perceived as the bill collectors.

Client Surveys

To help address this issue, the surveyed clients were asked to rate their satisfaction with a series of program delivery features. Clients were also asked what the program could have done differently to help make the project more successful. To help assess satisfaction, they were also asked if they would recommend the program to others. Finally, from a more qualitative perspective, clients were asked to indicate what suggestions they had to improve the program, and what additional comments they had on the program. These all help address this issue.

Table 22 summarizes the satisfaction ratings for TPC clients. The table shows that, while clients are most satisfied with the staff (advice and assistance) as well as the program, overall, they are least satisfied with features affected by the various processes (speed of decision making, application, negotiation) and bureaucratic requirements (paperwork, reporting). This is related to the very extensive and time consuming approval process. As will be discussed in more detail in Section 5.2.4, it typically takes over a year to get approval for a project and reach agreement on the repayment details, before the project actually begins.

Table 22: TPC Client Satisfaction with Program Features (Average Ratings)

Feature	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
The advice you received from staff	8.0	8.0	8.0	8.6	7.6	7.8
The assistance you received from staff throughout the process	7.8	8.0	7.7	8.4	7.3	7.7
Your understanding of the funding process	7.8	7.8	7.8	8.2	7.7	7.6
Overall, with the program	7.8	7.8	7.8	7.8	7.2	7.9
The amount of time it took to get paid when you submitted claims	7.7	7.8	7.5	8.3	7.0	7.7
Clarity of the eligibility criteria	7.5	7.3	7.6	7.7	7.4	7.3
The negotiation process	7.0	7.0	7.1	7.6	6.1	6.9

Table 22: TPC Client Satisfaction with Program Features (Average Ratings)

Feature	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
The reporting requirements	6.9	7.3	6.6	7.0	7.2	6.8
The application process	6.7	7.1	6.4	6.7	6.8	6.6
Simplicity of paperwork	6.1	6.2	6.1	6.2	5.5	6.2
Speed of decision-making	5.7	6.3	5.1	5.6	6.2	5.6

Table 23 shows the satisfaction of IRAP-TPC clients with various aspects of the program. In this case, the table shows that IRAP-TPC clients are, in general, fairly satisfied with all aspects of the program. While they are highly satisfied with staff and the program overall, they are also very satisfied with most of the requirements and processes. The feature with which they are least satisfied is the simplicity of the paperwork.

Table 23: IRAP-TPC Client Satisfaction with Program Features (Average Ratings)

Feature	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
The assistance you received from staff throughout the process	8.5	8.1	8.6	7.8	8.9	8.6
The advice you received from staff	8.4	8.0	8.5	8.2	8.9	8.4
Overall, with the program	8.4	7.8	8.4	7.0	8.6	8.4
The amount of time it took to get paid when you submitted claims	8.2	8.3	8.2	6.8	8.8	8.1
The reporting requirements	8.0	7.6	8.1	6.8	8.5	8.0
Clarity of the eligibility criteria	7.8	6.7	7.9	6.5	8.3	7.8
Your understanding of the funding process	7.8	6.9	7.9	6.5	8.3	7.8

Table 23: IRAP-TPC Client Satisfaction with Program Features (Average Ratings)

Feature	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
The negotiation process	7.5	6.8	7.6	7.5	7.5	7.6
The application process	7.1	6.7	7.2	6.3	6.6	7.2
Speed of decision-making	7.1	6.4	7.2	6.8	7.1	7.2
Simplicity of paperwork	6.9	6.1	7.0	6.5	7.0	6.9

Table 24 compares the satisfaction ratings of TPC and IRAP-TPC to those of other funding programs where comparable features were assessed using the same scale. The table shows that, in general, TPC has the lower proportion of “very” satisfied clients. On the other hand, IRAP-TPC is comparable to the IRAP program as a whole for speed of payment and its overall rating. The former Defence Industry Research Program (DIRP) at DND generally rates more favourably than both TPC and IRAP-TPC (except for clarity of eligibility criteria).

Table 24: Client Satisfaction with Program Features – TPC and IRAP-TPC Versus Others (% “Very” Satisfied)

Feature	TPC (8,9,10)	IRAP-TPC (8,9,10)	IRAP ‘96 (8,9,10)	DIRP (Very)
Clarity of the eligibility criteria	55%	65%		60%
Simplicity of paperwork	22%	44%	63%	68%
Your understanding of the funding process	65%	67%		
The application process	37%	55%		65%
Speed of decision-making	23%	55%	67%	
The reporting requirements	44%	73%		
The amount of time it took to get paid when you submitted claims	63%	73%	74%	
The negotiation process	44%	61%		

**Table 24: Client Satisfaction with Program Features – TPC and IRAP-TPC Versus Others
(% “Very” Satisfied)**

Feature	TPC (8,9,10)	IRAP- TPC (8,9,10)	IRAP ‘96 (8,9,10)	DIRP (Very)
The advice you received from staff	75%	78%	64% 54% *	91%
The assistance you received from staff throughout the process	69%	83%		
Overall, with the program	68%	72%	79%	92%

* Non technical advice / assistance and technical advice / assistance were rated separately.

As previously noted, 31% of TPC respondents said there was nothing that the program could have done differently to make the project more successful; another 17% did not know. The most frequently noted suggestions were to speed up the process (18%) and to have more money (11%). Similarly for IRAP-TPC, 31% said nothing could have been done and 7% did not know. Again, frequently noted suggestions were to have more money (16%) and to speed up the process (11%).

The great majority of TPC (94%) and IRAP-TPC (98%) clients indicated that they would recommend the program to others – a good indication of overall satisfaction with the program and / or belief that it is a worthy program.

When asked to provide suggestions for improvements to the TPC program, 14% of clients said there was nothing that needed improvement. The key suggestions were:

- ▶ to speed up the process (30%);
- ▶ to change the funding arrangements in some way (23%);
- ▶ to streamline the paperwork or reporting requirements (19%); and,
- ▶ to show more flexibility (18%).

For IRAP-TPC clients, 23% said there were no required improvements. The key suggestions were:

- ▶ better funding arrangements (23%); and,
- ▶ speed up the process (13%).

These results again indicate that, in general, IRAP-TPC clients are more satisfied than TPC clients.

When asked if they had any additional comments to make on the program, 52% of TPC clients and 59% of IRAP-TPC clients said there were none. The majority of comments from both TPC and IRAP-TPC clients were positive (about the program in general – 27% for TPC and 24% for IRAP-TPC; about staff – 10% for both TPC and IRAP-TPC; and / or others – 4% for TPC and 7% for IRAP-TPC; versus only 2% negative comments for both TPC and IRAP-TPC).

Case Studies

The case studies focussed on achievement of technical and commercial success and other related impacts. As a result, there were only a few comments about problems or dissatisfaction. One issue that came up in at least two case studies was the problems caused by the introduction of the Annual Information Update. The contribution agreements for the early projects during the 1990s made no specific mention of annual reporting requirements, but rather had a general note about the fact that TPC may request information. When the AIU was introduced, the letter from TPC stated that firms were now required to complete this form. Several firms, including two with case studies, reviewed their contribution agreements and, with the advice of lawyers, initially refused to complete the AIU, as it had not been identified as a requirement at the time of the funding approval. Interviewees commented that the tone of the letter from TPC was also not conducive to being co-operative. Eventually, all firms complied, but not without a lot of confusion and upset. One firm also noted that the information being requested had not been kept by the firm, so they found it difficult to provide the information. They also found the form to be confusing, particularly with respect to the calculation of person years of employment created or maintained. The fact that TPC changed the form was also identified as a complicating factor.

The transfer of management of the project from TPC to PPM was also a problem for one firm examined. In this case, the benefits phase and repayments began in 2000, but the firm was unaware of the existence of the PPM group until quite recently.

Several interviewees from the case studies recommended that TPC pay increased attention to clients after project approval, as well as improved communications and client liaison in general.

5.2.2 To what extent are project funding decisions consistent with program terms and conditions?

Document and File Analysis

The details of the eligibility criteria for the three components of TPC were discussed in detail in Section 4.2.2, and will not be repeated here.

TPC has very detailed policies and procedures for reviewing proposals and making funding decisions. These will be discussed in more detail in Section 5.3.5; however, some aspects of the procedures are relevant to addressing this issue. All TPC proposed projects go through a very extensive (some would say bureaucratic) review process before final acceptance. This includes detailed reviews by the TPC Management Board, that includes TPC managers and Industry Canada Sector Branch representatives. This review checks the proposal for consistency with TPC terms and conditions and government priorities. If the proposed project is approved at this level, it then goes to the Industry Canada Program Services Board, which reviews each project from the higher level perspective of Industry Canada. These extensive processes were put in place to ensure that these large projects meet all requirements of Industry Canada and the Government of Canada.

Several years ago, the Auditor General's office performed an extensive audit of several government innovation programs, including TPC. That audit was generally favourable to TPC and found that the agency followed government procedures appropriately. There was no evidence of problems with funding decisions.

A review of a sample of project proposals showed that in some cases, there were concerns about the commercial viability of projects that were approved. The project summaries did not provide any information about how risk would be mitigated, or why certain projects were approved over others in spite of high risk.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Several TPC interviewees commented that TPC now uses a two step approach to review firm inquiries for funding. In the first stage, firms complete an investment outline, that provides TPC with a short summary of the intended project. TPC uses the investment outline to make an initial filtering of possible projects. Those that are deemed eligible are prioritized, and those in the highest priority category are asked to provide a full project proposal. One TPC interviewee noted that TPC is not an entitlement program, and that the most important criterion and the first filter is whether the proposed initiative is consistent with government priorities. Industry Canada Sector Branches and other

government department representatives provided input on how well proposed initiatives link with government priorities. It was also mentioned by interviewees that program terms and conditions are quite general, and many projects can be justified within them. One serious problem is that there are insufficient resources to fund even half of the projects that are eligible, particularly in the enabling and environmental technologies sectors.

5.3.3 Who are the beneficiaries of the program? What is the profile of funded firms? To what extent is TPC reaching the intended target firms, including SMEs? How have co-delivery agents benefited from working with TPC?

Information related to this issue has been addressed a number of times in discussing program objectives and profile of funded firms.

A number of sources were examined in addressing this issue, primarily TPC and IRAP documents and project databases. The client survey also collected profiling information on the firms surveyed. Interviews with IRAP managers addressed the issue of the benefits to co-delivery partners. Because the TPC and IRAP databases do not collect information on firm size, the study relied on data from the client survey to examine this characteristic of funded firms.

Document and File Review

As mentioned previously, background documents linked to the creation of TPC identify a number of sectors that the program was intended to support. These included aerospace and defence, environmental industries, biotechnology, advanced manufacturing, and selected information technologies industries. The program was also intended to be accessible to high technology SMEs from all regions of the country.

Documents show that TPC program delivery is consistent with providing support to these target sectors. TPC has three program delivery groups, one each for aerospace and defence, environmental technologies and enabling technologies (biotechnology, information technology, advanced materials and advanced manufacturing). TPC has brought NRC's IRAP in as a co-delivery partner to manage the delivery of smaller projects to SMEs using the IRAP Industrial Technology Advisor (ITA) national network.

In order to examine the types of firms receiving funding from each of the three TPC program components, each firm was placed into one of the major industrial groups, following a review of the firm website. Tables 25 to 27 describe the results of the analysis, showing both the number of projects and the number of firms.

Table 25: Types of Firms Receiving TPC Aerospace and Defence Funding¹

Firm Type / Sector	Number of Projects	Number of Firms
Aircraft engine manufacture, maintenance	12	4
Aircraft component manufacturing	25	13
Aircraft manufacturing, production	2	2
Communications, electronics systems	29	21
Space related	3	3
Other ²	7	7
Total	78	50

¹ a number of firms have more than one project

² other - automotive, other manufacturing, shipbuilding, water treatment

As can be seen from the Table 25, many aerospace firms have more than one TPC project. Also, the large majority of firms with aerospace and defence projects are directly linked to the sector. Most of those in the communications and electronics systems business have the aerospace and defence sector as their primary if not sole target client focus.

Table 26: Types of Firms receiving Enabling Technologies Funding*

Firm Type	Number of Projects	Number of Firms
Biopharmaceuticals	13	10
Medical devices, equipment	3	3
Aquaculture	1	1
Biotechnology - total	17	14
Telecommunications	15	15
Computers, software, information technology	2	2
Semiconductors, electronic devices	5	5
Information Technology - total	22	22
Other (packaging, fabrication) – total	3	3
TPC Total	42	39

* several firms have two projects

As shown in Table 26, the largest fraction of projects in this category are with firms in the telecommunications (36%) and biopharmaceutical (31%) sectors. Based on this analysis, projects in the enabling technologies group provide the large majority of funding to help firms directly involved in the enabling sectors identified as TPC's focus. Only a few firms have more than one TPC project.

Table 27: Types of Firms Receiving Environmental Technologies Funding*

Industrial Sector	Number of Projects	Number of Firms
Aquaculture equipment	1	1
Alternative energy production, systems	8	8
Control systems, information technology	4	3
Chemical products, supplies	1	1
Aircraft, other engine manufacturing, maintenance	5	3
Oil and gas production	2	1
Automotive	1	1
Water purification, recycling	4	3
Other (lighting, forestry, etc.)	5	4
Total	31	25

* several firms have two projects

As can be seen in Table 27, TPC has funded projects involving the development of environmentally related technologies with firms in a wide variety of industrial sectors. The largest single group is involved in some aspect of alternative energy production or use. This includes energy from biomass, production of hydrogen, fuel cell developers, etc. Firms involved in water purification and recycling of liquids also have projects linked to environmental improvement and sustainable development. It is interesting that a total of five firms with seven projects in this program area also have projects within the aerospace and defence program.

Database Analysis

The TPC and IRAP-TPC client databases were analyzed to produce information about the geographic distribution of funded firms, the number of projects by component and size and by technology area of the project being funded. Tables 28 to 31 provide a summary of that information. The TPC database does not collect information on firm size, therefore such analysis could not be performed.

Table 28: Number and Value of TPC Projects, and Average Project Size by Region*

Region	Number of Projects	Value of TPC Contributions	Average Size of Contribution
West (BC, AB, SK, MB)	37	\$278 M	\$7.5 M
Ontario	88	\$720 M	\$8.2 M
Quebec	44	\$918 M	\$20.9 M
Atlantic (NF, NS, NB, PEI)	5	\$18 M	\$3.6 M
Canada	174	\$1,934 M	\$11.1 M

* database includes all continuing projects since 1996, when TPC began. No projects from 2003 are included.

According to information in the database, there were no TPC funded projects in Saskatchewan, New Brunswick or Nova Scotia. It is important to remember that most TPC projects are with large, industrially oriented firms (over 500 employees) in the three sectors being supported, and that these are concentrated around large cities and industrial centres. While the Quebec region has half as many projects as Ontario, they are more than twice as large, on average. This reflects the heavy concentration of support for large aerospace firms that are mostly situated in Quebec.

As can be seen, TPC focuses on relatively large projects typically three times the size of the TPC contribution. These are undertaken in most cases by large firms.

Table 29: Number of Projects by TPC Program Area

TPC Program Area	Number of Projects
Aerospace and Defence	78
Aerospace and Defence Supplier Development	16
Enabling Technologies	46
Environmental Technologies	31
Other	3
Total	174

Table 29 demonstrates that the TPC strategy is to fund relatively few, large projects. The program has funded a total of 174 projects since 1996, a total of 7 years. This is an average of 25 projects per year, in all three components. The average project has had

over \$30,000,000 in eligible costs, with TPC funding providing about 30% of total project costs.

Table 30: Number and Value of IRAP-TPC Projects and Average Project Size by Region*

Region	Number of Projects	Value of IRAP-TPC Contributions	Average Size of Contribution
West (BC, AB, SK, MB)	120	\$45 M	\$375 K
Ontario	98	\$45 M	\$459 K
Quebec	70	\$22 M	\$314 K
Atlantic (NF, NS, NB, PEI)	35	\$12 M	\$343 K
Canada	323	\$124 M	\$384 K

* database contains all continuing projects since 1998, when IRAP-TPC began. Only three projects from 2003 are included.

Table 30 shows that, as expected, IRAP-TPC projects and funding are more widely distributed regionally. IRAP-TPC supports SMEs, that are more widely spread than larger firms. IRAP-TPC has funded projects in every province. Saskatchewan, Newfoundland and PEI have seven, six and eight projects respectively. The maximum IRAP-TPC contribution to any project is \$500,000, based on a maximum project size of \$1,500,000.

Table 31: Number of IRAP-TPC Projects by Technology Area

Technology Area	Number of Projects
Aerospace and Defence	10
Enabling - Advanced Manufacturing	64
Enabling - Advanced Materials	17
Enabling - Biotechnology	24
Enabling - Information Technology	163
Environment	33
Other (unspecified)	12
Total	323

Table 31 shows that the distribution of projects funded by IRAP-TPC are quite different than that of projects funded by TPC directly in terms of technology. A much higher percentage of IRAP-TPC projects are linked to the enabling technologies (83% compared to 26% for TPC), with about half linked to projects involving information technology in some form.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Several TPC interviewees stated that, while each firm that receives TPC funding benefits from the project, the major group of beneficiaries are the large aerospace firms that benefited from the DIPP program, and that continue to be supported by TPC. With the support of DIPP and now TPC, Canada has developed a small number of aerospace firms that manufacture major components and build final products that compete successfully internationally. These include Bombardier (regional aircraft), Pratt and Whitney Canada (#2 world wide in sales of small jet engines), Gooderich and Messier Dowty (landing gear manufacturers), Rolls Royce (repair and overhaul in Canada), Honeywell (aircraft systems), and CAE (aircraft simulators). Interviewees noted that individual firms in the information technology, biotechnology and environmental technology sectors have also benefited. However, because most Canadian firms in these sectors that were funded are at a much earlier stage of maturity and are less well known on the world stage, in most cases, the commercial benefits will take much longer to occur. Also, because of the higher risk, it is expected that there will be more commercial failures, and a lower overall level of repayments.

Client Survey

TPC has identified that its target client group includes firms, organizations and institutions established in Canada, which are prepared to conduct research, development and innovation activities in the eligible areas (i.e., industrial research, pre-competitive development, and studies in the aerospace and defence sector, environmental technologies, and enabling technologies).⁶ The survey of clients obtained the following profile information on client organizations: primary industry sector, number of years in business, and number of full-time, part-time and highly skilled employees at the time of application for program funding as well as at the time of the survey.

Table 32 identifies the industry sectors of the TPC client organizations surveyed. The table shows that there are no noteworthy differences in the profile of firms funded earlier

⁶ Source: Technology Partnerships Canada Evaluation and Accountability Framework, 2001.

(with work phase completed) versus those funded more recently (with work phase not completed). It also shows that, not surprisingly the majority of aerospace projects involved firms in the aerospace sector (72%), a large proportion (46% including oil and gas) of the environmental projects involve firms in the environment sector and those organizations undertaking enabling technologies projects are spread across a wide range of sectors.

Table 32: TPC Client Industry Sector

Industry Sector	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
Information technology	9%	7%	11%	16%	0%	8%
Aerospace	37%	41%	32%	72%	0%	30%
Telecommunications	13%	11%	16%	8%	0%	20%
Pharmaceuticals	4%	4%	5%	0%	0%	8%
Biotechnology	7%	4%	9%	0%	0%	12%
Environmental	7%	9%	5%	0%	31%	2%
Other manufacturing	16%	18%	14%	4%	38%	14%
All others	7%	6%	8%	0%	31% ¹	6%
Total number of firms	90	46	44	25	13	50

¹ Of the 31% in “other”, 15% are involved in mining and oil and gas extraction.

Table 33 show the sectoral distribution of IRAP-TPC client organizations.

Table 33: IRAP-TPC Client Industry Sector

Industry Sector	Total	Complete	Not complete	Aerosp.	Enviro.	Enabling Tech.
Information technology	35%	34%	35%	20%	8%	39%
Aerospace	3%	0%	4%	80%	0%	0%
Telecommunications	7%	9%	7%	0%	0%	7%
Pharmaceuticals	1%	0%	1%	0%	0%	1%
Biotechnology	2%	8%	1%	0%	0%	2%
Environmental	4%	8%	4%	0%	33%	1%
Other manufacturing	22%	17%	22%	0%	34%	22%
All others	26%	24%	26%	0%	25%	28%
Total number of firms	120	12	107	5	12	97

In terms of the maturity of the TPC and IRAP-TPC funded organizations, the survey results show that the TPC client organizations have been in business for an average of 25.5 years whereas IRAP-TPC client organizations have been in business for only 8.2 years, on average. The survey results also show that 3/4 of the TPC firms (75%) have been in business for 10 years or more whereas 69% of IRAP-TPC client organizations have been in business for less than 10 years. The survey results showed that the age of the funded organizations was fairly similar across most of the subgroups examined (work phase completed, not completed, project area). However, those firms receiving TPC funding for aerospace and defence projects have, on average, been in business for more years than those involved in environmental and enabling technologies (32.6 years for aerospace and defence versus 23.5 for environmental and 22.9 for enabling technologies).

Size of firm is an important element of the profile of funded firms, particularly given the importance of assisting SMEs. The survey results show that, based on the number of full-time employees at the time organizations applied for program funding, the great majority of TPC funded organizations (86%) were SMEs with fewer than 500 full-time employees. In fact, the majority (83%) are still SMEs. For IRAP-TPC clients, all (100%) were SMEs at the time of application and 99% still are.

5.2.4 To what extent has TPC formed effective partnerships with other program delivery organizations? In what manner have these partnerships helped TPC better deliver the program and achieve objectives? How has working with TPC helped partners?

The primary sources of evidence to address this issue were the TPC Annual Reports and Business Plans and interviews with TPC and IRAP managers and staff.

Document and File Review

The initial TPC 1996-97 Business Plan identified the need to develop partnerships in order to deliver the program to SMEs. The plan identified a number of potential partners, including the Information Technology Association of Canada, the Alliance of Manufacturers and Exporters Canada, the Canada-Israeli Industrial Research and Development Foundation, NRC, Regional Development Agencies and the Business Development Bank of Canada.

By the next year, 1997-98, TPC was negotiating with NRC's IRAP for the delivery of the program to SMEs. Under an agreement negotiated in 1998, TPC and IRAP each agreed to provide \$15,000,000 annually to fund projects valued at up to \$1,500,000 for SMEs. (As of April 1, 2003, IRAP will be delivering TPC to SMEs for larger projects, up to \$3,000,000 in eligible costs. TPC and IRAP will contribute equally to the increased costs of delivery.) Since then, TPC also has entered into an MOU with NRCan's Climate Change Secretariat for additional funding from the Climate Change Action Fund and Technologies Early Action Measures, to complement TPC's funding of environmental technologies projects related to the reduction of greenhouse gases and sustainable development. In 1998, through the Canadian Landmines Fund, \$3,500,000 in additional funding over the next five years was also provided to TPC to support the development of demining technologies. This program was led jointly by Industry Canada and DND, but was cancelled recently due to lack of interest.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Several TPC interviewees agreed that IRAP is TPC's major true partner, but that TPC also has connections to the regional development agencies, DRDC, and NRCan (Climate Change), and is seeking more.

IRAP interviewees identified the Canadian Technology Network, the Canadian Institute for Market Intelligence and the Canadian Marketing Association as organizations that IRAP-TPC partners and consults with to provide project due diligence from a business / market perspective.

Client Survey

As previously discussed, the client survey results show that, in general, IRAP-TPC clients are more satisfied with various aspects of program delivery than TPC clients.

In addition, IRAP-TPC clients have been reasonably successful in achieving program objectives related to:

- ▶ economic growth (i.e., 44% have increased revenues of firm when expected; 29% increased profitability; 69% increased competitiveness of firm);
- ▶ job creation (i.e., 91% maintained existing highly skilled jobs when expected; 82% created new highly skilled jobs; average growth in highly skilled jobs of 13.1%; 43% experienced long term job growth when expected; 48.5% average growth in full-time employment);
- ▶ sustainable development (30% reported environmental impacts resulting from the project);
- ▶ maintenance and growth of technological capabilities in Canada (90% developed new or improved technologies when expected; 90% improved technological capability of firm; 56% indicated diffusion or adoption of technology beyond firm);
- ▶ encouragement of SMEs in all regions of Canada (100% of firms were SMEs when funded; all regions of Canada involved); and
- ▶ incrementality (31% full incrementality; 58% high incrementality).

This indicates that IRAP is an effective co-delivery partner in helping TPC deliver the program and achieve objectives.

5.2.5 Is TPC being delivered in an efficient and effective manner?

This issue is closely related to the following one, that focuses on changes to the design and delivery of TPC. In addressing this issue, the emphasis will be on identifying areas in which TPC is not being delivered in an efficient manner. Section 5.3.6 will then address means of improving the design and delivery to improve efficiency and / or effectiveness.

Document and File Review

One indicator of efficiency is the level of administrative costs. This has been discussed previously in Section 4.3.3. TPC has kept the costs of program administration at or near 3% of annual allocation for most years. TPC has recently decided to increase resources devoted to program management and delivery. For 2002-2003, the cost of program management was approximately 3.8%, an increase of over 20%.

As part of cost control, TPC has had a long standing effective cap on staffing. The 1996-97 Business Plan showed that the TPC organizational structure had 50 positions. This structure has remained relatively constant until recently, when TPC undertook a major organizational review, and decided to increase staff significantly. Information provided by TPC showed that the number of FTEs of employment in 2001-2002 was 54, whereas the number of planned FTEs for 2002-2003 was 70, an increase of about 30%. While TPC has kept the staffing level down, the program has also had a number of contract positions and contractors performing duties that in many government departments would be done by program staff.

A Business Plan is used by management to describe plans for delivering the program over the next year or more. As such, it reflects management's view as to the present effectiveness of program delivery, and the improvements that need to be made. On this basis, TPC management believe that there are a number of changes that need to be made. The most recent 2002-2003 Business Plan has a major section identifying "Priorities Requiring Immediate Attention", and "Priorities to be Addressed During Fiscal Year 2002-2003". Topics included are:

- ▶ revitalizing communications;
- ▶ implementing reorganization;
- ▶ revisiting business methods;
- ▶ reporting on TPC's Operational Review;
- ▶ maximizing the impact of Program funds (cash management);
- ▶ reviewing repayments;
- ▶ human resource management;
- ▶ pursuing business development; and,
- ▶ enhancing and measuring performance.

Clearly, TPC management believes that the effectiveness of the program is in need of improvement. Communications, cash management of funds and performance measurement have also been identified in previous Business Plans as requiring improvement.

An extensive review of documents related to TPC project approval processes, including a sample of project files, was undertaken, in addition to a number of interviews with project delivery staff, in order to understand and describe the processes and groups involved throughout the life of a project. A summarized version of the processes and players, focussing on the main aspects of the process, is shown in Table 34. As can be seen, the process is very extensive, and time consuming. It typically takes over a year to get approval for a project and reach agreement on the repayment details, before the project actually begins. The table also identifies the many groups involved in the application, approval and contracting processes. As well as TPC personnel, these include Industry Canada Sector Branch staff, the Industry Canada Program Services Board, PWGSC and Justice Canada. The Work Phase involves PWGSC and TPC staff and the Benefits Phase following completion of the project involved the Industry Canada Policy and Program Management Group.

There are several key highlights to Table 34. These are:

- ▶ The time to project approval (1 to 1½ years or more) represents about 30% of the time from application to end of project work phase (on average, 3½ years for work phase; and on average, 5 years from investment outline to end of project work phase). Most of this is in the application phase. On the other hand, the majority of approved investment outlines (approximately 1/3 of the total time to project approval) for which proposals are received are approved in the end. In other evaluations for innovation programs, it has generally be noted that delays in the innovation stage are problematic since it could result in firms losing their competitive advantage (i.e., someone else develops the product / process / technology first).
- ▶ In other evaluations, it has generally been concluded that the more the client is involved throughout the process, the more likely they are to understand it and thus be satisfied. The table shows that clients are involved in some way in all stages of TPC projects. However, as previously noted, client satisfaction with various aspects of the process is not very high. This is likely due to the amount of time required for many stages.
- ▶ There are at least three stakeholder groups involved in each step of the process, in some cases as many as seven. Particularly at the application phase, this appears to add to the time line.

This process can be contrasted with the IRAP process for SMEs, which is much less bureaucratic and time consuming. The firm is guided through the process by an IRAP Industrial Technology Advisor, who provides technical and administrative support. All

processes are managed within the IRAP organization and project application, approval and contracting usually take much less time.

TPC has recognized the benefits of timely processes and has introduced a streamlined process for the Aerospace Supplier Development program, that provides funding for projects up to \$2,000,000 in eligible costs for small firms supplying the aerospace and defence sector.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

A number of TPC interviewees identified what they perceived to be problems with the management and delivery of TPC that affect the effectiveness of the program. Their comments will be discussed under a number of general topics, namely:

- ▶ project approval processes;
- ▶ cash flow / resource management; and,
- ▶ communication, project and performance monitoring and reporting.

Table 34: Time Line and Involvement of Participants / Stakeholders in the TPC Program

Project Stages / Phases	Participants / Stakeholders										Time Line
	Firm (client)	TPC	IC / OGDs	6 IC Sectors	PSB	MB	IC PPM	EBCA	PWGSC / Justice / CAC	TB / Cabinet	
Pre-Application Phase											
Program promotion	✓	✓	✓								On-going
1 – Investment outline	✓	✓		✓				✓			Not known
2 – Prioritization	✓	✓	✓	✓				✓			3-6 mths
Application Phase											
3 – Proposal preparation	✓	✓		✓				✓			4-12 mths
4 – Due diligence	✓		✓	✓					✓		3-5 mths
5 – Approval	✓	✓		✓	✓	✓		✓	✓	✓	3 mths
6 – Contracting	✓	✓							✓		3 wks
Work Phase											
7 – Claims and progress reporting	monthly / quarterly	monthly / quarterly							monthly / quarterly		On-going (<5 yrs)
8 – Annual reviews and amendments	annual	annual		✓					annual		On-going (<5 yrs)
9 – Final review	✓	✓					✓		✓		1 mth
Benefit Phase											
10 – Benefits Reporting / Repayment administration	annual	✓					annual		✓		On-going (5-10 yrs)

Note: Shaded areas show on-going / key involvement or involvement at multiple times during the process. Check marks (✓) indicate involvement at one particular point in the process.

Project Approval Processes

A number of TPC and Industry Canada interviewees reported concerns with various aspects of the TPC project approval process. It was identified as very long and bureaucratic, and seriously impeding the effectiveness of program delivery. Some interviewees noted that, for companies that have never applied before, the process can be very confusing. Problems begin with the first stage, where firms provide an investment outline for their proposed project. Staff reported that many project outlines received are ineligible for a variety of reasons. According to interviewees, in many cases, these are received from firms applying for funding from the environmental or enabling technologies groups for the first time, who have applied directly after reviewing the TPC website, without discussing their potential project with anyone from TPC. To counteract this problem, TPC has recently removed the Investment Outline Application Form from the website, and now requests potential applicants to contact TPC before applying.

Another problem noted by interviewees relates to the prioritization process that occurs following the receipt of the investment outline. This is a critical process, as many projects are removed from consideration at this time. This is particularly true for the Enabling and Environmental technologies components, that have many more applications than they can fund with existing resources. Some people involved in the prioritization process commented that these decisions are made with insufficient information, particularly with respect to intellectual property. One interviewee commented that “we never have enough critical information needed to make an informed decision”. Several interviewees commented further that the standard Investment Outline may be sufficient for making decisions on projects in many sectors, but not for all. For example, for applications for biotechnology projects, information on access to intellectual property and genetic material may be critical for project success, but this information is not provided in the Investment Outline Application Form.

Other interviewees questioned the value of requiring all projects with more than \$500,000 in TPC funding to go to the Industry Canada Program Services Board for approval. This process typically added considerably to the time for approval, yet was perceived as adding little or no value.

Cash Flow / Resource Management

Some TPC interviewees noted that the nature of the funding process and the relatively large amounts of funding for many projects make cash management difficult. The funding process ties up large amounts of TPC funds until the project is approved and the contribution agreement completed. Delays at any stage can push approval into the next fiscal year, leaving TPC with unspent funds. Interviewees commented that delays can be caused within TPC by workload issues, excessive time taken by Industry Canada Sector

Branches or OGDs in commenting on the proposal for the due diligence process, or by the firm in deciding whether to accept the TPC conditions on funding. Interviewees also noted that the rapid and unexpected downturn in IT and aerospace economic conditions also contributed to the willingness and ability of firms to both undertake new projects and spend funds for projects in the work phase. Interviewees noted that, because of these circumstances, TPC has Treasury Board Secretariat (TBS) permission to carry forward or carry back up to 20% of annual funding into the new fiscal year.

Communication, Project Monitoring and Reporting

Several interviewees were concerned that the continual spotlight on TPC by the media was affecting program delivery. There were a number of related comments that the Annual Reports provided by TPC had not helped the situation. For example, the 2000-2001 Annual Report was released in May 2002, at the same time as the 2001-2002 report. Also, some interviewees noted that reports have tended to provide only a very general overall positive picture of the program. While always factually correct, they did not communicate some of the realities of the program, nor set the proper expectations for the program. For example, it was noted that some projects are high risk, and have a low probability of being commercially successful by their nature. However, although the information is contained in internal documents, TPC has never stated in its Annual Reports or in any public communication that the program was designed to expect only about 50% of funds provided to be repaid, once again due to the high risk of projects. By not communicating the specifics of the program design and expectations, TPC has left itself vulnerable to criticism and misunderstanding.

Another area of concern, that some interviewees felt limited the ability of program management to effectively manage the program, was project and program performance monitoring and reporting. Some interviewees reported that the emphasis by TPC project officers on getting projects approved left little time for management of projects in the work phase. In some cases, files were not kept up to date or data provided by the firm was not carefully reviewed, leading to incorrect or incomplete project data. Also, TPC has recently changed its processes, and is now transferring projects from the TPC project officer to a PPM officer at the start of the benefits phase. Interviewees reported that there have been a number of problems associated with the introduction of this new process. Evidence suggests that PPM has focussed on collecting repayments, which is what the group has been trained to do, and has spent less effort on examining and confirming forecasts of jobs and leverage provided by the firms in the AIUs.

There were also a number of comments related to performance measurement and reporting. This issue will be discussed separately in Section 5.3.10.

5.2 6 Are there changes to the design and delivery of TPC that could better deliver the program and / or achieve objectives?

This issue was addressed primarily by analyzing recent TPC Business Plans and asking TPC, IRAP and OGD interviewees for suggestions to improve the program. The issue of Performance Measurement and Reporting will be discussed separately in Section 5.3.10.

Document and File Review

There have been several other sections of the report that have identified problems that need to be addressed. These include the analysis of the 2002-2003 TPC Business Plan in the previous section that identified priorities. TPC Business Plans also identify opportunities in a number of areas for changes to improve program design and delivery. In some cases, these changes require new authorities from Treasury Board or Cabinet. In reviewing the TPC 2000-01 to 2002-03 Business Plan, a number of initiatives were identified. They include:

- ▶ monitoring projects and program results;
- ▶ management of benefits phase monitoring and receivables;
- ▶ developing and implementing a risk management strategy;
- ▶ enhanced use of Information Management / Information Technology;
- ▶ enhancing TPC's funding flexibilities - reprofiling and allocation between sectors (TB approval required); and,
- ▶ increasing public awareness of TPC and its contribution to Canada's economic and social well being.

Some of these have been discussed previously, particularly in the preceding section.

The recent market study of SMEs that have received IRAP-TPC assistance reported a number of changes to the design and delivery of the TPC program by IRAP that funded firms felt would enhance the program. These included:

- ▶ increasing the number of eligible technology areas, or removing eligibility restrictions;
- ▶ increasing the ceiling of eligible costs beyond \$1,500,000;
- ▶ increasing the percentage of eligible costs covered; and,
- ▶ increasing the types of activities that can be included in eligible costs (i.e., competitive intelligence and market analysis).

Some firms surveyed also suggested that the program should provide financial support to help SMEs access professional expertise and/or diagnostic services. Some SMEs also

suggested that the program should develop mechanisms to link SMEs to venture capitalists and other alternative financing sources.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Project Approval Processes

Several interviewees identified the need to streamline the approval process and reduce the administrative burden. The high level of administrative burden associated with developing a proposal and getting it approved was identified by several interviewees to have several impacts. First, there are often long delays between receiving a proposal from a firm and final approval, and this can affect the project's timeliness. Secondly, from a program delivery perspective, the administrative burden on TPC staff, coupled with the limit on administrative expenses to 3% of program budget, means that staff have had to prioritize their duties, leaving some tasks uncompleted, such as following up with clients after projects are approved, and keeping records and files up-to-date. One interviewee noted that the limit on management expenses has also meant that TPC has not been able to adequately resource and put in place many management functions important to program management and delivery. Examples given were strategic policy level advice and performance measurement and monitoring. Interviewees commented that streamlining the approval process would free up resources for better monitoring of projects during the work phase, however, some felt that there may still be a need to increase the percentage of funds spent on program management and administration beyond the 3% level.

Another related impediment noted was the reliance that TPC places on Industry Canada line branches to provide strategic intelligence on the needs of the sectors. The interviewee commented that, with the downsizing of the mid-nineteen nineties, the Branches lost a lot of experienced people and there is now less strategic guidance available from these sources. It was suggested that TPC seek out new sources of advice and intelligence, perhaps beyond the public service.

It was also pointed out that TPC program delivery was originally designed based on the DIPP procurement model that had been developed for the aerospace and defence sectors. This model is appropriate for large projects involving incremental product development, for which the work phase can be planned in detail. In the other sectors, the approach is less appropriate, as projects may require considerably more flexibility than a procurement model with well defined project steps can provide. Some interviewees suggested that TPC may need to customize the project approval processes by component. There may even be a need to have different processes for biotechnology compared to the other enabling technology areas.

It was pointed out that TPC is presently reviewing the program delivery model, with a view to better aligning it with present day reality, reducing unnecessary administrative burden and improving program effectiveness.

Cash Flow / Resource Management

Several interviewees offered suggestions to improve the cash flow situation. One suggestion was to set service standards or even deadlines for various stages of the processes. For example, if a firm was to take longer than an agreed upon time to respond to TPC during the approval stage, perhaps one month, then the funds for that project would be released for other projects. Another TPC interviewee suggested that TPC make better use of its flexibility and be more aggressive in managing projects and funds. Rather than just banking uncommitted funds for future years, TPC could adopt the alternative strategy of borrowing against future years. TPC could effectively “over book project approvals” and, if necessary in the event that more projects came through than expected, borrow funds from the next fiscal year.

Allocation of Funding

There are two perspectives to the issue of reducing the allocation of funding to the aerospace and defence program and increasing it to and enabling and environmental program areas. First, those involved in delivering the enabling and environmental components have more eligible requests for funding than they can address within the existing budgetary allocations, and consequently turn down a large proportion of requests. The situation is made more complex by the recent downturn in the aerospace sector. However, as one interviewee commented, Canada has spent several decades and many public resources in supporting the aerospace and defence sector and, if funding were to be significantly reduced, there is a serious risk that some of the major international aerospace firms would reduce their Canadian operations and move production to other, more supportive countries. The interviewee went on to say that TPC funding is very important to this sector.

Several interviewees noted that TPC funding can meet the needs of only a small fraction of firms in the enabling and environment areas. While important to the firm, and to the achievement of government objectives, the \$100,000,000 available annually from TPC can provide only a small fraction of the innovation funding needs of these sectors (IT, biotechnology, alternative energy, etc.), and is not as important to the sectors as to the aerospace and defence sector. For these reasons, one interviewee suggested that TPC needed to think very carefully before reducing funding to the aerospace and defence sector.

Communication, Project Monitoring and Reporting

Several interviewees suggested that TPC should communicate a more complete view of the program, that clarify reasonable expectations for the program, including the fact that many TPC funded projects are breakthrough, high risk ventures that may not produce an economic return and commercial success. They suggested that the fact that, due to the nature of projects, TPC expects to collect over the long term, about 25% of forecast repayments, or 50% of contribution funds should be part of the message. Several interviewees suggested that repayments should be put in better context and de-emphasized, compared to other program outcomes. It was also suggested that the annual report should also present more of the actual results, rather than focus on forecast predictions.

Several TPC interviewees noted that projects need to be better monitored during the work phase, especially as this phase comes to an end. The file information, including AIUs needs to be complete and up-to-date as the responsibility for project management during the Benefits Phase is transferred to the Industry Canada Policy and Program Management Branch. Several interviewees also commented that PPM Branch needs to monitor and confirm that all information collected from the firms in the AIU is accurate, rather than focus on repayments.

It was recommended that the newly introduced practice of having a meeting with the firm at the end of the work phase, attended by both the TPC Project officer and the PPM officer taking over the file be continued and followed for all projects, as it facilitated good communication, client co-operation and the transition of project management from TPC to PPM.

Client Survey

In terms of changes to the design and delivery of the program, clients were asked to identify what the program could have done differently to help make the project more successful. Many comments made by TPC clients are consistent with the concerns identified through the documents and interviews. For example, many suggestions from survey respondents about improving the program are related to the project approval process (18% said speed up the process; 2% mentioned a simpler process), the allocation of funding (11% asked for more money; 7% longer funding periods; 4% fund a broader scope of activities), and most importantly, communication, project monitoring and reporting (4% more consultations; 6% reduce reporting requirements; 9% more flexibility; 3% more advice / ongoing support). IRAP-TPC clients noted similar concerns.

In addition, when asked for suggestions for improvements to the program, as previously noted, the key suggestions were:

- ▶ speed up the process (30% for TPC; 13% for IRAP-TPC);
- ▶ better funding arrangements (23% for TPC; 23% for IRAP-TPC);
- ▶ streamline the paperwork (19% for TPC; 9% for IRAP-TPC); and,
- ▶ more flexibility (18% for TPC; 8% for IRAP-TPC).

Case Studies

One issue with respect to program design and delivery is related to repayments, and in what circumstances the firm should repay the TPC contribution. The case studies provide examples of the two main approaches being followed. The initial approach used by TPC was to make repayments relates to royalties on sales of the product or process being developed in the TPC funded project. In the four TPC cases examined, this was the approach used, and in two cases, repayments are below the amounts originally forecast by significant amounts. In the other two cases, repayments are not yet scheduled to begin, however, revised forecasts are for payments to be lower than originally forecast. Table 35 below provides a summary.

Table 35: Forecast vs. Actual Repayments

Company	Originally Forecast Repayments to End of 2002	Actual Repayments to End of 2002
MDS Aero Support	\$1,250,000	\$13,000
Teleflex GFI	\$2,632,000	\$749,000
IBM Canada ¹	\$0 (repayments begin in 2003)	\$0
Messier Dowty ²	\$0 (repayments begin in 2004)	\$0

¹ work phase ends in 2002

² work phase ended in 2000, but royalties begin after sale of 10th set of landing gear, with first payment due at end of 2004

IRAP-TPC funded projects examined use a different repayment approach, one that is being adopted for the TPC Aerospace Supplier Support Program and more and more for the larger TPC projects. In this approach, repayments are based on firm revenues, often above a threshold. Repayments are therefore not project or product specific, but are related to a general improvement in firm capability, leading to higher sales. With this approach, unlike the other one, the firm may have to repay the contribution even if the project is a commercial failure. This was the case with Smartsight, which successfully moved to a totally new line of business unrelated to IRAP-TPC funded project, and still has to repay the contribution. The rationale for this approach may be that, irrespective of project success, the firm is still more technologically capable and has additional trained highly skilled personnel that can contribute to firm success through other projects. This

would provide a rationale for collecting repayments based on the benefits to the firm of the funding.

While the risk of non-repayment is significantly lower with this approach and it is much less burdensome administratively, it may not be consistent with the philosophy and design of the program, where risk and reward are to be shared between the parties, and the funding was designed to be conditionally repayable. TPC and IRAP may both need to review their repayment policies for consistency with program objectives and design.

5.2.7 What impact has the SOA status and structure had on TPC's ability to deliver the program, and achieve program objectives?

Document and File Review

The TPC Business Plan for 2000-01 describes the fact that TPC's status as a Special Operating Agency within Industry Canada is the mechanism by which TPC has been given the additional financial flexibilities to carry over unused contribution funds up to 20% of annual funding and to recycle repayments back into TPC. Other programs within Industry Canada do not have these flexibilities.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Most interviewees were unable to identify any particular benefits that the SOA status provided TPC. They did not notice many additional flexibilities. One person suggested that TPC is in fact more exposed as an SOA, than if it were within Industry Canada. The one major positive factor that one interviewee noted is the ability to carry over 20% of annual funding (\$60,000,000). The limitations on resources devoted to management and administration were considered major negative factors linked to the SOA terms and conditions.

5.2.8 Is the SOA structure the most appropriate for TPC? Are there changes to the SOA authorities that can improve program delivery and achievement of success?

Document and File Review

As discussed previously in Section 5.2.6, TPC is seeking additional flexibilities from TBS with respect to carry over of funds and allocation of funding between sectors (2/3 for aerospace and defence 1/3 for enabling and environmental).

Table 36 provides information from TPC Annual Plans on funding levels, allocations and reprofiling, to demonstrate the need for funding flexibility. As described in the Business

Plans, the large carry forward amounts occur at least in part because in some years with an economic downturn, firms are unable to provide their share of project funding and projects are delayed. This pushes planned project funding back into the next year, and decreases TPC expenditures for the current year. There was also a single major event that impacted on TPC. In 1998-99, the WTO ruling resulted in significantly reduced projects being undertaken in the aerospace and defence sector, and enabling and environmental was unable to ramp up to absorb the extra funding. This led to reduced expenditures and a larger level of carry forward funds.

Table 36: Funding Levels, Allocations and Reprofileing (in millions of \$)

	Year						
	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03
TPC A base funding	150	200	250	300	300	300	300
OGD funding	0		13	18	22	16	16
Repayments						4	7
Funds available from carry forward		21	15	67	169	202	185
Funds carried forward	-21	-15	-67	-169	-202	-185	-109
Program reductions ¹ , funds transferred to IC, not eligible for carry forward ²				-7 ²	-9 ²	-6 ¹	-18 ¹³
Funds for sunset programs	-51	-24	-1				
Administration costs	-5	-7.5	-8	-10		-12	-11
Contribution funding dispersed	73	174	203	200	263	320	370

¹ Industry Canada reallocated \$6,000,000 to other programs on a permanent basis

² Funds outside the 20% carryforward permitted to TPC

³ Industry Canada reallocated an additional \$12,000,000 one time to fund the Innovative Engagement Strategy initiative

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

As mentioned in the previous section, a number of TPC interviewees identified having additional resources for program management and administration and an increase in financial flexibilities as helping to improve program delivery. Changes in the program

delivery model, particularly for the enabling and environmental Sectors was also identified as helping improve program success.

5.2.9 Are the responsibilities for management and delivery of the program and achievement of success clearly defined between Industry Canada, TPC and the Advisory Groups?

Document and File Review

TPC has an extensive Policies and Procedures Manual that defines in considerable detail the procedures for delivery of the program. From that perspective, the responsibilities are clearly defined.

The background documentation related to the formation of TPC placed great emphasis on the program being market driven and results oriented, with advice as to overall direction provided by a private sector based Advisory Board. In addition, the 2002-2003 TPC Business Plan includes the TPC Performance Measures which, under Partnerships, and the extent to which TPC consults with its operating partners, states that TPC will:

- ▶ convene the TPC Advisory Board at least twice yearly;
- ▶ conduct quarterly meetings of the Interdepartmental Advisory Committee;
- ▶ hold meetings of the TPC Management Board weekly, or on an as required basis; and,
- ▶ at least once per year, meet with and brief the major industry associations within the A&D and E&E components.

Under Accountability, and the extent to which Program and client accountability targets are established by TPC and agreed to by its parent department, TPC Performance Measures state that, under Program accountability:

- ▶ the Executive Director of TPC reports directly to the Associate Deputy Minister of Industry Canada;
- ▶ TPC's Annual Report is tabled in Parliament, thereby placing TPC's performance and results in the public domain; and,
- ▶ all investments greater than \$500,000 are tabled at Industry Canada's Programs and Services Board (PSB) thereby subjecting them to further detailed scrutiny outside TPC.

Under client accountability, the measures state that TPC will adhere to Client Service Standards, involving the timeliness of responses to submission of client documents and claims.

It should be noted that there are no specific requirements for what information is to be included in the TPC Annual Report. There is also no requirement for collecting information on and reporting to Industry Canada or publicly on the performance measures that were included in the revised terms and conditions under which TPC is required to operate. There is no evidence that TPC provides this information to Industry Canada, other than the partial information available through the Annual Report, or that it forms part of the accountability agreement between TPC and Industry Canada. This is discussed further in the following section.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

While it may be a performance target for the TPC Advisory Board to meet twice annually, information from TPC managers confirms that the Board has not met in about two years. This information was not mentioned in the 2001-2002 Annual Report, and the 2002-2003 TPC Business Plan does not identify any plans to meet this target or change it.

5.2.10 Does TPC have an operational Performance Measurement and Reporting System, that is used for program management, and that provides information required for annual performance reporting and periodic in-depth evaluation studies?

Document and File Review

There has been considerable attention paid in the Annual Business Plans to this issue. The initial 1996-97 Business Plan reported that TPC had developed an evaluation framework to establish an ongoing program performance monitoring strategy and plan for the eventual evaluation of the program within five years.

The 1998-99 Business Plan included a list of performance measures under the following categories:

- ▶ leverage
- ▶ repayments
- ▶ economic benefits
- ▶ strategic balance
- ▶ accessible to SMEs
- ▶ regional balance
- ▶ accountability

► partnerships

The 1999 document entitled Special Operating Agency Framework contained revised Terms of Reference and Performance Measures for TPC, approved by Treasury Board, that reflected the WTO ruling and moved the program away from near market support towards R&D. The performance measurement categories remained essentially the same as previously, with relatively small changes such as removing indicators related to sales. Those performance measures are still in use.

The 1998-99 Business Plan also identified an initiative to review and validate the performance measures, resulting in the adoption of an enhanced Performance Measurement Framework for TPC, that would reflect the changing reality of TPC's operations. The plan identified the development and adoption of a two-tier approach. Tier One would provide data and analysis for ongoing, mostly mandatory monitoring of program delivery and meeting of operational objectives. Tier Two would focus on periodic measurement of project outcomes and impacts that are present at the end of or shortly after the project work phase. These include technology development and related benefits to the firm.

TPC Annual Reports report on some of the agreed upon performance measures. Table 37 provides a list of the performance indicators and identifies those included in the Annual Reports.

Table 37: TPC Performance Indicators

Key Result Category	Principle	Indicator	Reported Annually¹
Leverage	1. Financially innovative	a. Weighted average TPC sharing ratio b. Dollars of total innovation spending leveraged per dollar of TPC investment	yes ² yes
Repayment	2. Fiscally responsible	a. Ratio of repayments collected in FY to disbursements in the FY b. Dollars of repayments per dollar of investment c. Ratio of actual repayments earned to originally forecasted repayments d. Ratio of repayments collected to repayments receivable	no no yes ² no
Economic Benefits	3. Results oriented	a. Average investment per job created or maintained during work and benefits phases b. Distribution of jobs created or maintained by type of skills and by region	no no

Table 37: TPC Performance Indicators

Key Result Category	Principle	Indicator	Reported Annually ¹
Strategic Balance	4. Multi-sectoral	a. Ratio of total dollars of TPC investments in environmental and enabling (E&E) technologies and aerospace and defence (A&D)	yes annual and cumulative
Regional Balance	5. National coverage	a. The number and total value of TPC investments by region (West, Ontario, Quebec and the Atlantic)	yes annual and cumulative
Accessible to SMEs	6. Fair and equitable access	a. Total distribution of TPC investments by value and number of projects between SMEs and large firms	yes annual and cumulative
Partnerships	7. Based on Collaboration	a. The extent to which TPC consults with its operating partners	no
Accountability	8. Accountable	a. Program and accountability targets established by TPC and agreed to by its parent department	no

¹ the TPC 2000-01 and 2001-2002 Annual Reports were used to prepare this table.

² not provided in the TPC 2001-02 Annual Report

The first evidence that TPC has gathered and analyzed information on the full range of performance indicators is provided by a report dated October 2002, entitled Reporting on 2000-2001 Program Performance Results. This report, and the accompanying memorandum to senior management, is indicated to be *a first prototype of the summary report*.

The report states that Tier Two level performance measurement information first mentioned in the 1998-99 Business Plan is not included, as it is subject to further development work.

Interviews with TPC, Industry Canada Sector, IRAP and Other Government Department Representatives

Interviews with TPC managers and staff confirmed that TPC has been planning to develop and improve its performance measurement and reporting system for several years, and has made some advances in data collection, but still has much to do before an integrated PMRS system is operational. The information that is presented in the Annual report is provided from the TPC data collection system. While the October 2002 report entitled Reporting on 2000-2001 Program Performance Results is an important first step, interviewees were not able to provide information on the extent to which TPC management has made use of the information in the report to inform decision making.

Several interviewees also reported that there is considerable pressure from Industry Canada senior management to develop improved performance measurement capability, including the identification of additional qualitative and descriptive performance measures related to longer term technical and commercial success at the firm level resulting from TPC funded projects. This is to complement the quantitative information being collected presently on person years of employment (jobs), additional company spending due to TPC funding (leverage), company revenues and repayment of TPC contributions.

One IRAP interviewee stated that IRAP-TPC also needs to make progress in this area. One suggestion was to develop a standardized template to identify and collect information on the technical, economic and social benefits of each project. The interviewee also recommended that notification that this template would be part of the firm's reporting responsibility be included in each project contribution agreement.

6.0 Lessons Learned

6.1 Research Questions

What specific lessons have been learned with respect to the delivery of TPC and the achievement of program objectives?

What factors have facilitated / impeded the effective delivery of TPC?

What factors have facilitated / impeded the achievement of TPC objectives?

6.2 Detailed Findings

6.2.1 What specific lessons have been learned with respect to the delivery of TPC and the achievement of program objectives?

This question has, in many respects, been dealt with previously when addressing the specific research questions in Sections 3, 4 and 5 under the general topics of relevance, program success, and design and delivery. The lessons learned were often discussed in the form of identification of specific problems in program design and delivery and / or suggestions for change. A number of the major lessons learned are restated here in summary form, under general headings.

Differing Needs of Industrial Sectors

As discussed in sections 4.2.1 and 4.2.2, interviewees noted that TPC has to try to meet the needs of industry groups at very different stages of maturity, market acceptance and risk. TPC design and delivery was based to some extent on DIPP, a program designed to support near to market development projects in the aerospace and defence industries. These industries are relatively mature, and innovation focuses primarily on modifications and improvements to existing technologies. Projects tend to be relatively low risk, with a defined and well known market demand. By contrast, many Canadian firms in the environmental and enabling technologies sectors are involved in developing breakthrough technologies and products in emerging and highly risky markets. It is very difficult for TPC to meet the needs of these highly diverse sectors through a single program with common selection criteria, policies, program delivery approach and procedures.

Due Diligence vs Flexibility

There is a very real conflict between traditional application of government policies and procedures and the flexibilities required for supporting innovation. TPC projects involve very large amounts of funding, and it is important that decisions as to their use are appropriate and well considered. However, it is clear from evidence collected through interviews and the survey that the extensive and time consuming due diligence procedures and multiple approval levels followed for the main TPC program are serious impediments to the delivery of an efficient and effective program. TPC has recognized this problem and has instituted much reduced requirements for the Aerospace Defence Supplier Program. Also, IRAP-TPC has a much less time consuming and bureaucratic process for making funding decisions for its smaller projects (up to \$3,000,000).

Insufficient Resources for Program Management and Delivery

It is clear from discussions with program staff and other sources that the 3% limit on resources and the limit on staffing allowed for program management and delivery that was imposed when the program was created in 1996 have affected TPC's ability to manage the program effectively. The situation has become worse as the number of projects administered by TPC has increased. The extensive due diligence and approval processes and need to monitor an ever increasing number of projects have imposed heavy demands on the limited resources available.

Narrow Focus on Program Objectives

When TPC was formed in 1996, the objectives of the program and the indicators identified to determine program success were focused on job creation and the extent to which funds were being repaid. This narrow focus on commercial success missed the very important outcomes related to project technological success, such as improved technological capability of the firm and increased competitiveness that are necessary precursors for the firm to have long term commercial success. The focus on repayability, which will only occur years after the work phase of the project is completed, also makes it difficult for TPC to demonstrate early success. The focus on repayability also ignores the high risk nature of TPC projects. While most TPC projects can be expected to be technologically successful, fewer will be commercially successful and these reach the TPC repayment phase.

The focus on commercial success became even more of a problem following the change in program focus in 1999, when projects moved away from close to market projects, with a relatively high likelihood of commercial success, to earlier stage product development and pre-commercialization projects, which are more directly focused on improving firm technological capability and competitiveness, with the expectation that this will

eventually lead to commercial success. Unfortunately, TPC did not adjust its performance indicators when the program was adjusted in 1999, in response to the WTO ruling.

The unfortunate result is that TPC objectives and overall program success are being assessed by stakeholders and the public using narrow and inappropriate measures.

6.2.2 What factors have facilitated / impeded the effective delivery of TPC?

Much of the discussion earlier in the report and in Section 6.2.1 applies here as well, and will not be repeated. To a considerable extent, the details of the original design and delivery of TPC in 1996, have had some unintended consequences for the effective delivery of the program.

Factors Facilitating Delivery

Familiarity with Program Purpose, Approach

As noted by interviewees in TPC and Industry Canada, the familiarity of firms in the aerospace and defence sectors with the design and delivery of DIPP, the predecessor of TPC, made the transition to TPC support easier for this target group than for the others, who had no experience with this type of program. Similarly, the awareness of the Industry Canada Automotive and Aerospace Branch of the needs of the aerospace and defence sector, and its support and advice, facilitated the development of suitable proposals from firms in these sectors, resulting in a high level of approvals.

Introduction of IRAP as a Co-Delivery Partner

TPC's strength is to deliver a small number of large projects to selected firms. The decision in 1998 to involve IRAP as a co-delivery partner for smaller scale projects with SMEs contributed greatly to the efficient, effective delivery of TPC to these firms. IRAP's familiarity with the technological needs of SMEs, the technical capability of its field staff, its wide geographical base, and its credibility made TPC more widely accessible to this target client group. As of March 31, 2003, IRAP-TPC had 323 projects under administration and TPC had 174. As shown by the survey responses, as a group, IRAP-TPC clients are more satisfied with service delivery than TPC clients.

Co-ordination with Other Government Programs

The linkage and co-funding of TPC Environmental Technologies projects by NRCan's CCAF and TEAM for initiatives involving reduction in greenhouse gases helped attract

good proposals, focus program delivery and make a larger amount of funding available for high priority projects aligned with government objectives.

Factors Impeding Delivery

Accountability and Control

Based on evidence from staff interviews, document review and survey responses, the emphasis on extensive due diligence and controls to ensure accountability have clearly impacted negatively on timeliness of decision making, which is seen as a major problem by firms making proposals. This focus has also placed heavy demands on program resources.

Demand for Environmental and Enabling Technologies Funding

The main TPC program is designed to fund a relatively small number of large, multimillion dollar projects each year. Within the \$100,000,00 available for Environmental and Enabling Technologies projects, a total of 10 to 15 projects may be approved. Unfortunately, there is much more demand for funding than can be met. The program objectives and selection criteria that are published are quite general, and many firms make funding proposals. Program staff noted that this has resulted in a considerable number of initial inquiries that do not meet program selection criteria and must be denied. All inquiries must be carefully reviewed and dealt with, placing a significant burden on program staff and limited resources.

6.2.3 What factors have facilitated / impeded the achievement of TPC objectives?

Again, much of the discussion earlier in the report and in Section 6.2.1 discusses factors internal to the program. It applies here as well, and will not be repeated. As mentioned previously, the extensive due diligence and multiple levels of approval have delayed the start of projects and by so doing have reduced the ability of firms to move quickly to build technical capability and meet a window of opportunity.

However, it is clear that the largest single factor impeding the achievement of TPC objectives related to long term jobs, economic growth and wealth creation is external to the program, and is related to the technological and economic environments of the past few years. The dot.com crash, 9/11 and the downturn in the aerospace market have all affected the ability of TPC funded firms whose projects have completed the work phase to achieve commercial sales, and economic growth. In addition, the downturn has affected the ability of some firms with projects still in the work phase to contribute their share of funding, slowing down the completion of projects. In addition, the severe downturn in the aerospace sector has limited the ability of firms in this sector to begin

new projects, resulting in lower demand over the short term, until market demand improves. This has been less of a factor for the other areas, as there is still more demand than can be met.

Annex A – List of Acronyms

Annex B – Government Interviewees

Annex C – TPC Interview Guide for TPC / IRAP and OGD Managers

Annex D – TPC versus IRAP Survey Results

Annex E – Survey Results for Projects with Work Phase Completed and not Completed

Annex F – Survey Results by Type of Technology

Annex G – In-depth Client Interview List

Annex H – Case Studies

H.1 TPC Funded Projects

H.1.1 Messier Dowty - Aerospace and Defence Component (large firm)

H.1.2 MDS Aero Support Corporation - Aerospace and Defence Component (small firm)

H.1.3 IBM Canada - Enabling Technologies Component

H.1.4 Teleflex GFI - Environmental Technologies Component

H.2 IRAP -PA Funded Projects

H.2.1 MetTech Incorporated

H.2.2 Groupe ComTech Link / Smartsight