Evaluation of the Intellectual Property Mobilization Program

Final Evaluation Report

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NSERC

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April 14, 2008

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Executive Summary

Introduction

This report presents the findings, conclusions, and recommendations from an evaluation of the Intellectual Property Mobilization Program, conducted in 2007. Established in 1995, the IPM program is the granting agencies' (NSERC, CIHR, and SSHRC) main tool to strengthen the ability of universities, research hospitals, and colleges to manage their intellectual property, attract potential users of their IP, and promote the professional development of intellectual property personnel. Since 1995, 107 institutions have received or participated in 116 IPM grants totalling $46.9M.

Since the IPM program was launched, it has undergone significant design changes, in part due to the initiation of other funding programs, and in part due to the environment in which the program operates. Consequently, a summative evaluation that focused solely on the outcomes of the program was not entirely appropriate. As a result, the evaluation had three main objectives:

- To determine if the IPM program has evolved in an appropriate manner (the right mix of objectives, funding streams, and partners);
- To determine the impact of the IPM program to date; and,
- To determine if the IPM program is still necessary, and if it is, the form that it should take in the future to ensure it is most effective.

The evaluation's methodology relied upon five lines of evidence:

- A review of the IPM database and approximately 30 documents including program literature and documents concerning technology and knowledge transfer from academic institutions;
- Key informant interviews with 16 representatives from Industry Canada, the granting agencies, and their relevant committees;
- A comparison of potentially complementary or overlapping federal, provincial, and regional programs;
- The conduct of mini-case studies of 17 institutions and 3 networks that received IPM funding. Funding to these institutions and networks

represents more than half of IPM grants and more than two-thirds of IPM funding to date; and,

- An online survey completed by over 350 program stakeholders, including: 34 VPs of Research; 41 TTO/ILO Directors; 176 researchers who engage in technology transfer or knowledge transfer activities; 39 persons that participated in training supported by IPM; and representatives from 69 firms that partnered with institutions in the co-development of technologies.

Key Findings

Relevance

The evaluation examined the obstacles that Canadian institutions face in their efforts to conduct technology and knowledge transfer and the need to continue to support their efforts. The evaluation concluded that institutions face many significant challenges and the need for support remains strong.

The most significant obstacle that Canadian institutions face is the operating budgets of their TTOs/ILOs. The budgets of most institution are generally small and/or tight, and only a few offices have developed healthy commercialization revenue streams. The evaluation survey found a wide divergence between the current and preferred levels of support from funding sources for TTO/ILO budgets. For example, TTO/ILO Directors reported that over half (57%) of TTO/ILO funding comes from institutional general operating funds; however, VPs of Research indicated that they would prefer their institutions accounted for only 14% of TTO/ILO budgets. VPs of Research would also prefer IPM funding to account for about 17% of their budgets, rather than the current 5.1% reported by TTO/ILO Directors.

At the same time that offices are faced with tight budgets, research funding and activity has increased significantly at Canadian institutions in recent years and institutions are placing more emphasis on commercializing this research. This trend has led to a sharp increase in the number of invention disclosures that technology transfer offices must evaluate, as well as the number of patents, licenses, industry partners and receptors that must be managed. As a result, many TTOs/ILOs do not have enough licensing officers to operate as effectively as they could. Instability surrounding TTO/ILO funding also poses

a significant challenge. Because university and hospital budgets have no surplus funds to hire additional technology transfer staff, they often rely on provincial or federal program grants to hire or retain staff, however funding terms are often 2-3 years in length, meaning that valuable personnel are lost when funding ends.

In addition to having insufficient staff levels, there is a need to train existing staff to be more effective. For instance, there is a perception among some stakeholders that highly skilled technology transfer personnel are found in only a handful of Canadian institutions. There are not a great deal of people with the right mix of business and technical skills, and the salaries offered by TTOs/ILOs are generally lower than those offered by the private sector, making employee retention a challenge.

There are several other significant obstacles. Many promising inventions are never commercialized because there is not enough money available to advance them to the point in which they would attract the interest of industry or qualify for funding from programs such as NSERC's Idea to Innovation (I2I) program and CIHR's Proof of Principle (POP). Finding partners is challenging for institutions because private sector firms in Canada tend to be small, inexperienced in technology transfer, and lack investment capital. The attitudes of some researchers toward commercializing research can be challenging for TTO/ILOs as well. According to some Directors and VPs of Research, there remain some researchers at Canadian institutions that are ambivalent or opposed to commercializing their research results.

The evaluation examined the structure of technology transfer offices in Canada and found that only about 10% of institutions have established a separate legal entity rather than house an internal TTO/ILO. As institutions become more established and sophisticated in their technology transfer activities, and commercialization revenues increase, the number of institutions that establish separate legal entities may increase. Regardless of whether or not offices are separate legal entities, their mandates are relatively consistent. Typically, the mandates focus on supporting researchers and transferring knowledge and technology to the public and private sector with an emphasis on social benefits. The focus on commercialization revenues; however, can be somewhat stronger at TTOs/ILOs that are separate legal entities.

Results/Impacts

The evaluation examined the extent to which the IPM program has accelerated technology and knowledge transfer at Canadian institutions. Evidence gathered by the evaluation, in conjunction with data from Statistics Canada, confirm that the rate at which technology is being transferred from universities and hospitals has increased dramatically in the last decade. For instance, commercialization revenue of universities and hospitals increased from $21 million to $55 million between 1999 and 2005.[1] Due to the fact that IPM is one of several sources of funding that institutions draw on to conduct technology and knowledge transfer activities, the impacts of the IPM program could not be separated out and precisely quantified. However, the evaluation was able to reveal where the program has had the greatest impact.

The evaluation revealed that technology and knowledge transfer is a labour intensive business, and IPM funding has played an important role in helping offices to address insufficient staffing levels. Salary support has been critical for small universities, by either supporting the position of the TTO/ILO Director, or an additional commercialization officer. Salary support has also been particularly critical at research hospitals, many of which previously had no dedicated full-time resource to conduct technology transfer activities. Survey findings from the evaluation revealed that licensing revenues and patents increased at TTO/ILOs that increased their FTEs in the last five years, while the opposite was true for offices that did not increase their FTEs.

Technology and knowledge transfer requires highly skilled personnel, preferably with a mix of scientific and business experience. IPM has assisted institutions to develop the skills of TTO/ILO staff by providing funding for professional development initiatives. The most significant initiative has been regional internship training programs, which offer the following benefits: a relatively standardized approach to developing interns into technology transfer professionals; an effective mechanism for attracting qualified candidates; and a way to reduce hiring risks for TTO/ILOs by allowing them to evaluate the potential of a candidate over many months at low cost, without the obligation to hire them. The immediate impact of IPM supported training activities (and

[1] Statistics Canada, Survey of Intellectual Property Commercialization in the Higher Education Sector, 1999-2005

additional personnel) has been some improvement in TTO/ILO service levels, which have been acknowledged by both researchers and IP receptors. Internship training programs will play an important role in the future because they help to create relationships between institutions, venture capital firms, and technology firms, and help to combat employee attrition and retirement.

The evaluation found that networks permit exploitation of the economies of scale in technology transfer, allowing smaller institutions to take advantage of the specialized expertise of larger institutions and their well-developed processes for the evaluation, patenting and licensing of technologies. Networks have also led to the sharing of information and best practices; the standardization of IP procedures and disclosure forms, and the establishment of non-disclosure and confidentiality agreements, which have encouraged cooperation across institutions. Networks have brought researchers together with common interests that have led to better technologies, and linked IP receptors with researchers that, in the absence of the network, would likely have not met.

The evaluation examined the extent to which program impacts vary by size of institutions and TTO/ILOs. With a few exceptions, larger universities generally have larger TTO/ILOs (as measured by FTEs), and smaller universities generally have smaller TTO/ILOs. Large research hospitals generally have small and relatively new TTO/ILOs, or merely one dedicated resource, rather than an office per se.

At small institutions, IPM funding accounts for a significant share of the operating budget (about 25%) and is often used to support the TTO/ILO Director or at least a full-time dedicated resource. The loss of IPM funding would jeopardize the existence of some small offices. At medium sized institutions, IPM funding accounts for on average, about 16% of the operating budget. The funding often supports additional commercialization officers rather than the Director, and generally increases the offices' ability to respond to the increasing number of researcher invention disclosures, and conduct outreach activities. The activities conduced by additional staff, have over time raised the commercialization figures of medium sized institutions. At large institutions, IPM accounts for on average, only 3% of office funding, supports

the salaries of additional commercialization officers or personnel with special expertise, and is sometimes used to launch new initiatives.

IPM program impacts vary more by size of institution than by region of the country. There are some regional differences worth noting. In Atlantic Canada, where many of the institutions are relatively small, IPM has been important for developing TTO/ILOs, providing salary support for TTO/ILO Directors, and supporting the regional network, Springboard. In Quebec, IPM has contributed to the development of downstream commercialization entities, which provide institutions with specialized expertise in evaluating the market potential of technologies and managing university spin-off firms. A significant impact in the Pacific and Prairie regions has been the support of the WestLink internship training program.

The evaluation found that the program's impact on knowledge transfer has been less significant than its impact on technology transfer. First, the amount of funding directed toward knowledge mobilization activities has been smaller. Second, there are few statistics available to measure knowledge transfer, and there appears to be some ambiguity among stakeholders as to what constitutes knowledge transfer. Nevertheless, the evaluation found that TTOs/ILOs perceive they are well suited to handle knowledge mobilization efforts, with about 80% of surveyed TTO/ILO Directors indicating that their offices currently handle it. The mini-case studies provided some anecdotal evidence of increased knowledge transfer activities, and the survey revealed that TTO/ILO Directors feel that IPM has positively impacted these activities.

The evaluation found some impediments to the program's objectives. A perception of researcher resistance to commercializing research and a tendency of institutions to offer stand-alone rather than bundled technologies to receptors have impeded IPM objectives. More results could also likely be achieved with higher IPM funding levels, particularly funding for pilot or demonstration projects to further advance promising inventions. The interdependency of various programs at the provincial and regional levels with respect to secured funding can cause funding to be delayed for offices located in some provinces.

Cost Effectiveness

Evidence from the evaluation indicates that the IPM is well managed and has a lean delivery model. There is significant cost sharing by institutions. Most of the significant regional and provincial programs that provide funding to TTOs/ILOs require funding to be cost shared, as does the IPM program.

Research conducted at Canadian universities, colleges, and hospitals has a significant impact on the economic and social well being of Canadians. There are several success stories, particularly in the biomedical field, where research has yielded tremendous economic and health benefits for Canadians. As one of several funding sources that support the efforts of institutional technology transfer offices, IPM has contributed to the success to date.

Conclusions and Recommendations

Appropriateness of Program Evolution

Although the evaluation did not address design and delivery issues explicitly, the evolution of the IPM program was assessed to determine the extent to which it has been appropriate. The design of the program has changed considerably since 1995.

In 2001, CIHR joined the IPM program, marking two important changes. First, the inclusion of CIHR recognized that there was untapped demand from the health research community, and promising inventions with potentially significant health benefits for Canadians were not being commercialized. Second, CIHR brought a significant funding increase to IPM and program demand jumped accordingly, up 51% from the 1998 competition. Findings from the evaluation show that hospital researcher participation rates have increased substantially from five years ago, confirming the appropriateness of the program design change.

SSHRC also joined the IPM program in 2001, reflecting the need to widen the focus of IPM beyond commercialization to include knowledge mobilization. TTO/ILOs provide an established structure and skilled staff that should assist knowledge mobilization to grow in Canadian institutions. The impact of SSHRC joining IPM has been less clear than the impact of CIHR, however.

There would appear to be some anecdotal evidence of increased knowledge transfer activities in recent years due to IPM, however, the main focus of offices remains technology transfer.

In 2002, the scope of the program expanded to include networked training in order to increase the pool of trained technology transfer personnel with hands on experience available to academic institutions. Evaluation evidence indicates that the evolution of IPM to include the funding of regional training programs has been appropriate to address several pressing challenges faced by TTO/ILOs, such as a lack of staff, skill deficiencies, and staff attrition. In reality, networked training has had wider reaching impacts than its original intended objectives. For example, as a result of relationships forged over six and eight month internships, and reinforced through networking conferences and meetings, training program graduates employed at TTOs/ILOs, venture capital firms, and technology companies have lead to a better understanding of each organization among, and created closer ties between, these types of organizations. As a result of these connections, commercialization deals are occurring that might not have occurred otherwise.

In 2005, individual awards to institutions were discontinued in favour of awards to groups of institutions. Many of the benefits of group awards have flowed to small institutions that have benefited from the expertise of larger institutions, but sophisticated institutions have benefited as well. The redesign of IPM to encourage networking seems timely given that collaborations among universities, hospitals, colleges, and centres of excellence are expected to become more important and prevalent in the future. In fact, networks and the Networks of Centres of Excellence are specifically identified as priorities in the Government of Canada's science and technology strategy, *Mobilizing Science and Technology to Canada's Advantage*.

The 2005 design change also expanded IPM funding to Canadian colleges. While it is too early yet to fully understand the impact of this change, available evidence from the evaluation suggests that the colleges have much to gain from participating in networks with larger and more sophisticated technology transfer offices of universities. In addition, colleges have applied technical capabilities that appeal to private sector firms interested in the co-development of technologies.

Despite the launch of a number of federal, provincial, regional, and municipal programs aimed at increasing the commercialization of institutional research, IPM remains relatively unique. There is no other program that offers infrastructure support directly to technology transfer offices right across Canada. IPM is not the only program that provides financial support to bridge the gap between invention disclosure and technology transfer, however, federal, provincial and regional technology transfer programs, in contrast, tend to provide funding for technologies that have been developed further and have already attracted industry partners.

Continued Need for IPM and its Future Design

The evaluation found several reasons why the IPM program is still necessary. First, the budgets of universities and hospitals are stretched and most have very small commercialization revenues. At the moment, technology transfer offices are trying to accommodate higher volumes of invention disclosures flowing from increased investment in research at Canadian institutions. Not surprisingly, demand for IPM funding has increased over time. The number of applications and the volume of funding requested continue to grow with each competition. Although a number of programs at the provincial and regional level that address innovation have been established in recent years, the IPM program remains the only source of funding to build TTO/ILO capacity for all institutions across Canada. The evaluation found that the loss of IPM funding would have consequences even for sophisticated technology transfer offices with relatively large budgets. These consequences include staff cutbacks, some decline in service standards, increased difficulty in identifying and hiring qualified personnel to counter the effects of turnover and retirements, and reduced commitment to new initiatives such as Entrepreneur in Residence programs. For small offices, the suspension of IPM funding could have severe impacts on the progress they have made to date, or in some cases, it may force small offices to close altogether.

The evaluation therefore concluded that if the IPM program were discontinued, and its funding not replaced by another source, the current pace of technology and knowledge transfer of institutional research in Canada would be reduced. The extent to which the pace would be reduced cannot be exactly quantified, however, the widespread use of IPM funding to retain, hire, and train

commercialization officers suggests that IPM is an important driver of the pace of commercialization within Canadian institutions.

As for the form the IPM program should take in the future, it should maintain a lean administrative structure; however, human resource levels should be sufficient to enable the program to undertake necessary follow up activities that the program has not addressed, such as outreach with clients and partners. TTO/ILO Directors and VPs of Research are highly experienced people who best know how to use resources to most effectively transfer institutional IP to the user sector. The program design should reflect the needs of institutions, namely funding for hiring, retaining, and training personnel, demonstration projects, networking, and internship training programs. In particular, the program's support of salaries of IP professionals is widespread and critical to building and maintaining the capacity of TTO/ILOs.

The program's future design should reflect the trends that we are currently seeing in technology transfer and knowledge mobilization. Those trends consist of more institutions working together; increasingly complex disclosures and technology, which are more time consuming for TTO/ILOs to evaluate and manage; increased knowledge mobilization activities by social sciences researchers; and, the likelihood that more technology transfer offices will be spun out of institutions. In light of these trends, IPM as currently designed, is appropriate, hence the evaluation team would caution against significant design changes at the moment.

Recommendation 1: The IPM program should be continued. The design of the program should continue to encourage TTO/ILOs to network with other institutions and pursue knowledge mobilization activities. Salary support for IP professionals should remain an eligible cost in the IPM design.

The evaluation found that institutions in close geographic proximity, rather than those with complementary research strengths submit most IPM group applications. Institutions with strength in a particular research area should be encouraged to pool their expertise and resources, regardless of geographic distance. This could offer an advantage to the private sector – knowledge

comes from one coordinated source, and there is better filtering and analysis of discoveries before the TTOs try to find interested receptors.

Recommendation 2: The program should encourage applications from institutions with complementary research strengths in addition to applications based on geographic proximity.

It is important that the IPM program management understands the implications from requiring institutions to contribute at least half of the cost of activities proposed in an IPM application. Many of the institutions that participated in the case studies do not have sufficient base funding to match IPM funds, and are forced to find alternative funding sources such as provincial or regional grant programs. This requirement poses an administrative burden on TTO/ILOs, whose staff can spend a considerable amount of valuable time finding and securing funds to contribute their share of costs associated with the activities proposed in an IPM application. In addition, in certain provinces the receipt of IPM funds may be delayed when a complementary source of funding is delayed. The evaluation found this to be the case for institutions in Ontario and BC.

Recommendation 3: If the granting agencies strongly believe in the need to support technology and knowledge transfer at Canadian institutions, they should consider either reducing the IPM cost share ratio below 50-50 or make exceptions for some applications, to recognize the significant challenge that institutions face in contributing at least half of the funding required to conduct activities proposed in IPM applications.

There are overhead costs associated with conducting research (e.g., management and administration costs) and commercializing research (e.g., patent costs, market studies). Private sector firms currently pay overhead charges directly to technology transfer offices for the institutional research they co-fund. It is therefore logical for the IPM budget to reflect a percentage of NSERC, CIHR, and perhaps SSHRC research funding to institutions in recognition of the overhead costs imposed by funded research. Although the federal granting agencies' Indirect Costs Program is intended to address these increases to some extent, the evaluation found that just 6% of Indirect Costs Program funding is directed into TTO/ILO budgets. In light of recent increases

in research funding from the granting agencies, it also seems logical that IPM funding should increase over time.

The Committee on Research Partnerships has recently recommended that NSERC make a commitment to fund its technology transfer programs at a level equal to 3% of its institutional research budget. Because IPM is one of several technology transfer programs, there is some risk that IPM may not receive its fair share. At the moment, however, the program could not likely distribute additional funding since the value of proposals deemed worthy of funding in the last competition was less than the value of available funding. A disconnect therefore exists between TTO/ILOs which need additional funding and the grant funding approach currently taken by the granting agencies.

Recommendation 4: IPM program management should consider investigating why applications are not exhausting available IPM funding. The program may wish to consider meeting with TTO/ILO Directors to understand why. The program may need to invest in additional managerial resources to conduct such an exercise.

Recommendation 5: Assuming that funding in future competitions can be exhausted, NSERC should then consider pegging IPM funding at a fixed percentage of its research grants budget. CIHR and SSHRC should consider adopting a similar commitment to IPM funding levels.

1.0 Introduction

1.1 Background on the IPM Program

In June 1993, the Canadian University Intellectual Property Group (CUIPG) produced a report that amounted to a program proposal to the federal government to address the lack of university funding to accelerate technology transfer and to address the "commercialization gap" – from the point of assessment of potential to the point of co-development of intellectual property. While a number of federal programs existed at the time to assist institutions in research activities and innovation, no programs specifically addressed this gap.

In 1995, the Natural Sciences and Engineering Research Council (NSERC) launched the Intellectual Property Mobilization (IPM) program with a mandate focused on commercializing university research in the natural sciences and engineering fields. The program was expanded in later years to include the Canadian Institutes of Health Research (CIHR) and the Social Sciences and Humanities Research Council (SSHRC). The program is the granting agencies' (NSERC, CIHR and SSHRC) main tool to strengthen the ability of universities, research hospitals, and colleges to manage their intellectual property, attract potential users of their IP, and promote the professional development of intellectual property personnel. Since its launch in 1995, the program has been administered by NSERC. The anticipated impact of the program is the transfer of knowledge and technology resulting from research into increased economic activity, policy initiatives, social benefits, and improved health of Canadians.

In its original form, only NSERC funded the IPM program, and it focused primarily on commercial exploitation of university research in NSERC domains. Competitions were held in 1995 and 1998. Based on an identified need to expand into research areas beyond the natural sciences and engineering, CIHR and SSHRC joined the IPM program in 2001. As a result, the focus of the program shifted to include both technology and knowledge transfer and expanded beyond commercial exploitation to reflect the ultimate goal of the program – strengthening Canada's competitiveness in a knowledge-based

global economy. In 2002, the IPM program introduced personnel training, specifically referred to as "Networked Training," with the objective to increase the pool of trained technology transfer personnel available to Canadian universities and research hospitals.

In 2004, the IPM conducted a survey of its clients.[2] Based on the survey results, and an ever-changing environment, a number of design changes were made to the IPM. Grants to individual institutions were discontinued, in favour of network grants. In its current form, the program features two distinct streams of funding: group awards and internship training. Group awards provide funding to groups of institutions (universities, research hospitals and colleges) to support activities related to managing and transferring intellectual property resulting from research falling under the domains of CIHR, SSHRC and NSERC. Starting with the last major competition held in 2005, colleges became eligible for IPM funding as co-applicants on group grants. The internship training awards are similar in scope to the "Networked Training" awards introduced in 2002.

The IPM program is located within NSERC's Research Partnership Programs and administered by a Program Manager. An expert panel, consisting of representatives from the private and public sectors, review applications to the IPM program based on three broad criteria: the potential to increase knowledge and technology transfer; the quality of the proposal; and the demonstrated need for resources and budget. IPM grants are 3 years in duration; however, internship training awards are two years in length. Typically, grant funds are directed into the budgets of the university's technology transfer office (TTO) or industry liaison office (ILO) and administered by the director of the TTO/ILO. Grant recipients are required to submit to IPM management annual reports on the performance and expenditures as well as a final report outlining outcomes and impacts within six months of the completion of the grant. During the grant, the payment of subsequent instalments depends on the demonstration of satisfactory progress and a continued need for funds.

Since 1995, 107 institutions have received or participated in 116 IPM grants totalling $46.9M. From Exhibit 1.1 below, IPM grants have been distributed

[2] Canada. NSERC- CIHR-SSHRC. Survey on the Intellectual Property Mobilization Program, 2004.

geographically across Canada, with slightly more than half of grants awarded to Ontario and Quebec institutions.

Exhibit 1.1 – Geographic Distribution of IPM Grants

	Number of IPM Grants (based on location of principal applicant)					
Application Year	Western Canada	Central/ Prairies	Ontario	Quebec	Atlantic Canada	Total
1995	4	3	7	5	1	20
1998	2	4	9	7	4	26
1999	1					1
2000		1				1
2001	6	6	11	10	5	38
2002	1			1	1	3
2004			4		1	5
2005	5	2	8	5	2	22
TOTAL	19	16	39	28	14	116
% of Grants	16.4%	13.8%	33.6%	24.1%	12.1%	100.0%

Source: IPM database

In 2001, CIHR provided approximately 45% of grant funding, and matched NSERC funding in the 2005 competition (see Exhibit 1.2). SSHRC funding has totalled $430,000 to date, with $50,000 and $380,000 awarded in 2001 and 2005, respectively.

Exhibit 1.2 – IPM Grant Funding by Granting Agency

Application Year	Total IPM Funding Awarded	NSERC Funding	CIHR Funding	SSHRC Funding
1995	$5,369,250	$5,369,250	N/A	N/A
1998	$8,815,802	$8,815,802	N/A	N/A
1999	$100,000	$100,000	N/A	N/A
2000	$186,000	$186,000	N/A	N/A
2001	$13,335,000	$7,324,000	$5,961,000	$50,000
2002	$1,500,000	$1,500,000	$0	$0
2004	$453,700	$453,700	$0	$0
2005	$17,137,524	$8,378,762	$8,378,762	$380,000
TOTAL	$46,897,276	$32,127,514	$14,339,762	$430,000
% of Funding	100%	68.5%	30.6%	0.92%

Source: IPM database

Data presented in Exhibit 1.3 indicates that a significant share of IPM funding (16%) has been directed toward developing technology transfer professionals via internship training. To date, four networks representing four geographic regions of Canada have been awarded $9.6M to establish and conduct internship training.

Exhibit 1.3 – IPM Grant Funding for Internship Training

Application Year	WestLink (West and Prairies)	South-western Ontario Internship Program	InterVal (Québec)	Springboard (Atlantic Canada)	Total
1995	$100,000				$100,000
2002	$650,000		$450,000	$400,000	$1,500,000
2005	$1,100,000	$400,000	$752,000	$3,814,000	$6,066,000
TOTAL	$1,850,000	$400,000	$1,202,000	$4,214,000	$7,666,000
% of Funding*	24.1%	5.2%	15.7%	55.0%	100.0%

*Internship training funding only

Source: IPM database

1.2 Purpose and Organization of the Report

The purpose of this report is to present the findings and conclusions of the evaluation of the IPM program. The evaluation was conducted over the period from January to October 2007. The remaining chapters of the report are organized as follows:

- Chapter 2 presents the methodology for the evaluation including: the objectives and scope of the evaluation; evaluation issues; lines of evidence; and data limitations and reliability;
- Chapter 3 presents the key evaluation findings for each issue – relevance, impacts/results, and cost effectiveness; and,
- Chapter 4 presents the conclusions and recommendations for the evaluation.

2.0 Evaluation Methodology

2.1 Objectives and Scope of the Evaluation

In the more than ten years since the IPM program was launched, it has undergone significant design changes, in part due to the initiation of other funding programs, and in part due to the environment in which the program operates. Consequently, a summative evaluation that focused solely on the outcomes of the program was not entirely appropriate. In addition to assessing the impact of the Program to date, the evaluation focused on addressing issues that would assist NSERC, CIHR and SSHRC to determine if the program is still necessary, decide on their continued partnership in the program, and if so, ensure that the program is designed and delivered in an effective manner for the next competition. The evaluation therefore had three main objectives:

- To determine if the IPM program has evolved in an appropriate manner (the right mix of objectives, funding streams, and partners);
- To determine the impact of the IPM program to date; and,
- To determine if the IPM program is still necessary, and if it is, the form that it should take in the future to ensure it is most effective.

2.2 Evaluation Issues

The evaluation issues and corresponding indicators and data sources are presented in the Exhibit 2.1.

Exhibit 2.1 – Indicators and Data Sources to Address Evaluation Issues

Evaluation Issues	Indicators and Data Sources
Relevance	
1. Is there a continuing need to support technology & knowledge transfer infrastructure at universities, research hospitals, and colleges? • What are the most significant impediments and obstacles to carrying out successful technology transfer and knowledge mobilization? • What kind of support is needed (e.g., capacity building, patenting, training of technology & knowledge transfer personnel, networking (group awards)? • What challenges exist in obtaining appropriate personnel to carry out technology and knowledge transfer?	**Indicators:** • Opinions regarding historical and future need • Examples of obstacles/need (i.e., gaps) • Examples of support that would be effective **Data Sources:** o Literature and document review (program description, NSERC survey, reports, etc.) o Key informant interviews (Selection Committee, NSERC CRP, Industry Canada, NSERC, SSHRC, and CIHR reps) o Surveys (VPs of Research, ILO Directors, Researchers, IP users) o Case studies (ILO Directors, VPs research, Researchers, Trainees, IP users) o Review of other initiatives • Difference between amounts awarded and requested o IPM funding files

Evaluation Issues	Indicators and Data Sources
2. How does the IPM program fit into the environment in which it operates? How has this environment evolved over time since the inception of the IPM program? How is this environment expected to evolve? • What are the other sources of funding available to support technology transfer, knowledge mobilization, and commercialization at universities, research hospitals and colleges (including other funding from the granting agencies, other federal sources, provincial sources, private sources, funding from the institutions themselves, etc.)? • Do other funding sources overlap with the IPM program, and if so, how does this impact the IPM program? How do other programs dovetail with the IPM program? • What are the different organizational structures that different institutions use to carry out technology & knowledge transfer? What are the different attitudes to, cultures of, and objectives of technology and knowledge transfer in the different institutions?	• Existence/trends of other programs o Literature/document review (program description, NSERC survey, reports, etc.) o Review of other initiatives • Perception of overlap/complimentarity with other programs • Relative importance of IPM funding o Key informant interviews (Selection Committee, NSERC, SSHRC, and CIHR reps) o Surveys (ILO Directors) o Case studies (ILO Directors, Researchers) o Reviews of other initiatives • Perceptions on evolution/trends of TT/KT o Key informant interviews (Selection Committee, NSERC CRP, Industry Canada, NSERC, SSHRC, and CIHR reps) o Case studies (ILO Directors, VPs research) o Reviews of other initiatives • Structures of ILOs/TTOs, etc. and perceived advantages/disadvantages of various structures o Literature/document review (program description, NSERC survey, reports, etc.) o Surveys (VPs research, ILO Directors, Researchers, Trainees) o Case studies (ILO Directors, VPs research, Researchers)
Impacts/Results	
3. To what extent are the objectives and outcomes of the IPM program being achieved? To what extent can these outcomes be attributed to the program itself? • To what extent has there been an increase in knowledge and technology transferred from	• Evidence that IPM has contributed to increased knowledge and technology transfer to the user sector (# of technologies assessed, prototypes developed, patents, licences, revenues, spin-off companies, etc.) o Surveys (VPs research, ILO

Evaluation Issues	Indicators and Data Sources
universities, research hospitals, and colleges to the user sector, as a result of the IPM program? • To what extent are new users of research results (e.g., industry and appropriate public sector receptor capacity) involved with university, hospital, and college researchers, as a result of the IPM program? • To what extent has there been an increase in the number of researchers involved in technology and knowledge transfer as a result of the IPM program? • How has the ability of universities, research hospitals, and colleges to mobilize their intellectual property been strengthened as a result of the IPM program? • To what extent are technology & knowledge transfer professionals being comprehensively trained through the IPM program? Are these trainees new or pre-existing staff, or a mix thereof? To what extent is this training effective? • What impact do group awards of the IPM program have on the ability of networks of institutions to carry out technology/knowledge transfer and commercialization? To what extent do these networked institutions cooperate amongst themselves?	Directors, Researchers, IP Users) o Case studies (ILO Directors, Researchers, IP users, progress and final reports) • Evidence that IPM has influenced the reach of knowledge and tech transfer activities (i.e., more and new users of IP) o Surveys (VPs research, ILO Directors, Researchers, IP Users) o Case studies (ILO Directors, Researchers, IP users, progress and final reports) • Evidence that IPM has contributed to an increase in number of researchers involved in KT/TT o Surveys (VPs research, ILO Directors, Researchers) o Case studies (ILO Directors, Researchers, progress and final reports) • Trends in capacity and effectiveness of TTO over time (FTEs, training courses, sharing resources, client satisfaction, etc.) o Surveys (VPs research, ILO Directors, Researchers, Trainees) o Case studies (ILO Directors, VPs research, Researchers, Trainees, IP users, progress and final reports • Perceptions of IPM impacts regarding institution's ability to carry out KT/TT o Key informant interviews (IPM selection committee, NSERC CRP, Industry Canada, NSERC, SSHRC, and CIHR reps) • Evidence that IPM has contributed toward better trained professionals (more staff trained, better skills, quality training programs) o Surveys (VPs research, ILO Directors, Researchers, Trainees) o Case studies (ILO Directors, VPs

Evaluation Issues	Indicators and Data Sources
	research, Researchers, Trainees, IP users, progress and final reports) • Evidence of impact of group awards (i.e., cooperation, leveraging) o Key informant interviews (IPM Selection Committee) – may be perceptions only o Surveys (VPs research, ILO Directors) o Case studies (ILO Directors, progress and final reports) • Other potential supporting evidence of IPM impacts – Statistics Canada surveys of IP Commercialization
4. To what extent do the impacts of the IPM program differ by size of institution? The level of experience and sophistication that institutions possess with regards to technology and knowledge transfer? Region of the country?	• The same indicators and data sources will be used as per question 3. Where differences in impacts by size, level of experience and sophistication of institutions, and region of the country are noted, they will be analyzed and reported on.
5. What has been the impact of the IPM program becoming a tri-agency initiative in 2001? • How has the inclusion of research hospitals impacted the overall results achieved by the IPM program? • What percentage of TT/KT activities carried out by the institutions pertains directly to the each of the specific domains of the three granting agencies? i.e., what percentage of activities are NSERC related, CIHR related and SSHRC related? Are there any associated trends? (e.g., an increase in SSHRC related activities) • To what extent have knowledge mobilization (vs. technology transfer) activities been carried out by IPM grantee institutions since the scope of the program was first expanded? To what extent are the notions of technology transfer and knowledge mobilization complementary to each other, or not, within the context of the IPM program?	• Trends in distribution of IPM funds • Trends in TT/KT activities institutions • Impacts on TT/KT infrastructure at institutions • Complementarity of TT and KT o Document/literature review (NSERC survey, StatsCan surveys, AUTM survey, IPM funding files) o Surveys (ILO Directors, Researchers, IP users) o Case studies (ILO Directors, Researchers, IP users, progress and final reports) • Perceptions of extent to which IPM has facilitated TT versus KT since becoming a tri-agency initiative o Key informant interviews (NSERC, SSHRC, and CIHR reps)

Evaluation Issues	Indicators and Data Sources
6. What have been the impediments to achieving the IPM program's objectives?	• Evidence/examples of specific impediments and recommendations for overcoming them o Surveys (VPs research, ILO Directors) o Case studies (ILO Directors, VPs research, progress and final reports) • Perceptions of impediments and recommendations to overcome them o Key informant interviews (IPM Selection Committee, NSERC, SSHRC, and CIHR reps)
7. What have been the unintended impacts of the program? Have these unintended impacts been desirable or undesirable, and how so?[3]	• Evidence/examples of unintended impacts o Surveys (ILO Directors, VPs research) o Case studies (ILO Directors, VPs research, progress and final reports) • Perceptions of unintended impacts o Key informant interviews (IPM Selection Committee, NSERC, SSHRC, and CIHR reps)
Cost Effectiveness	
8. To what extent is the delivery model for the IPM program cost effective? To what extent are the institutions receiving IPM funds meeting their commitments to the program (e.g., cost sharing)?	• Direct comparisons of cost structures and delivery methods of other programs o Review of other programs (including interviews with program reps) • Perceptions of cost effectiveness of IPM with other programs/evidence of cost sharing o Key informant interviews (NSERC, SSHRC, and CIHR reps) o Surveys (ILO Directors) o Case studies (ILO Directors)

[3] This evaluation issue has been addressed as part of the findings under evaluation issues 3, 4 and 5.

2.3 Addressing Summative and Formative Evaluation Issues

In developing the methodology for this evaluation, evaluators recognized that because IPM funding has been widespread (107 institutions have received funding), a suitable control group could not be created. A control group for the purpose of the IPM evaluation would be a group of Canadian institutions that are similar in major respects (and ideally in every way) to IPM funding recipients (e.g., similar research expenditures, size of technology transfer office), with the exception that they have not received any IPM funding. If a control group of non-IPM recipients had existed, their technology transfer performance (e.g., commercialization revenues, number of active licenses) could have been compared with the performance of IPM funding recipients, and the difference observed would have been the impact of the IPM program.

Correspondingly, in the absence of a suitable control group, and based on the evaluation team's experience in evaluating federal government science and technology programs, the evaluation methodology drew heavily on the mini-case studies, supplemented by primary and secondary survey data to address summative evaluation issues (relevance, impacts/results and cost-effectiveness). The conduct of mini-case studies of a sample of institutions that have received a significant share of IPM funding was utilized to provide an in-depth and ground level view of the extent to which the IPM program has supported the ability of universities, colleges, and research hospitals to manage their IP, attract potential users, and develop IP professionals.

The evaluation's formative issues (design and delivery) were addressed through key informant interviews, the online survey of stakeholders, the review of other programs, the document and literature review, and the mini-case studies.

2.4 Lines of Evidence

The evaluation's methodology relied upon five lines of evidence: a document and literature review; key informant interviews; a comparison of potentially complementary or overlapping federal, provincial, and regional programs; mini-case studies; and an online survey of stakeholders.

Document and literature review

Approximately 30 documents were reviewed over the course of the evaluation (please refer to Appendix A for a list of documents). Key documents included program descriptions, a survey conducted by NSERC in 2004, Statistics Canada surveys and reports (1998-2004), a survey by the Association of University Technology Managers[4], and several reports and strategic documents on commercializing research in Canada. The IPM database was also reviewed extensively.

Key informant interviews

Key informant interviews were completed with 16 representatives from the following respondent groups:

- Granting agencies – NSERC, SSHRC, and CIHR (7 key informants);
- Representatives from the IPM grant selection committee (5);
- Representatives from Industry Canada (3); and,
- Representatives from NSERC Committee on Research Partnerships (1).

These interviews were conducted before the mini-case studies and surveys were initiated.

Mini-case studies

Mini-case studies were a key means to understanding the impact of the IPM program on institutions, networks, and other stakeholders, as they provided evaluators with a "ground level view" of the program at work. Working together, IPM Program staff, representatives from NSERC's evaluation branch, and the consulting team developed a framework to identify potential case study participants. The framework organized institutions and networks according to

[4] It should be noted that not all Canadian universities participate in this survey.

type of institution (i.e., large, medium, or small university, hospital, and network), and geographic location (i.e., Pacific, Prairies, Ontario, Quebec, and Atlantic). Using the framework, 39 institutions and networks that had received IPM funding were identified, with an effort to capture those that had received significant IPM funding, and at the same time, ensure a balanced mix of regions and types of institutions and networks were selected. Using the framework, the consulting team solicited the participation of 3 networks and 17 institutions. The institutions and networks that comprised the mini-case studies participated in 63 of 116 IPM grants (54.3%) awarded and accounted for $31.7M (67.6%) of IPM funding between 1995 and 2005 (see Exhibit 2.2). With the exception for the small granting year of 2000 (only $186,000 was awarded), these institutions accounted for no less than 50% of awarded funding in any year.

Exhibit 2.2 – Coverage of IPM Grants by Mini-Case Studies

Award Year	Grants Represented by Mini-Case Studies	Total IPM Grants	Mini-case studies as % of IPM Grants	IPM Funding Represented by Mini-Case Studies	Total IPM Funding Awarded	Mini-case studies as % of IPM Funding
1995	13	20	65.0%	$3,618,000	$5,369,250	67.4%
1998	13	26	50.0%	$5,677,004	$8,815,802	64.4%
1999	1	1	100.0%	$100,000	$100,000	100.0%
2000	0	1	0.0%	$0	$186,000	0.0%
2001	19	38	50.0%	$7,760,000	$13,335,000	58.2%
2002	3	3	100.0%	$1,500,000	$1,500,000	100.0%
2004	2	5	40.0%	$412,500	$453,700	90.9%
2005	12	22	54.5%	$12,617,524	$17,137,524	73.6%
TOTAL	63	116	54.3%	$31,685,028	$46,897,276	67.6%

Source: IPM database

The mini-case studies were based on two data collection methods: a review of applications and progress reports submitted by these institutions and networks concerning the IPM grants they received; and the conduct of interviews with approximately five persons.

For mini-case studies of institutions (i.e., universities and research hospitals), the first interview was typically with the Director of the institution's TTO/ILO, followed by an interview with the Vice President of Research, in order to

understand the history and structure of the technology transfer office, its mandate, and the activities undertaken with the IPM grants and their resulting impacts. Subsequent interviews were conducted with a researcher at the institution and a receptor that had used the services of the TTO (e.g., technology firm, university spin-off company, or public sector organization). These interviews provided evaluators with an understanding of the nature of their interactions with the office, the challenges they face in commercializing research, transferring knowledge, and dealing with the office, and perceived changes in office service levels since the introduction of the IPM program. In cases where the TTO employed a commercialization officer that received training sponsored by the IPM program, an interview was conducted with this person to understand the nature of the training received, its applicability to their current role, the impact of their training on the organization, and suggestions for how to improve training. Exhibit 2.3a presents the 17 organizations that participated in the institutional mini-case studies.

Exhibit 2.3a – Organizations Participating in Institutional Mini-Case Studies

Western Canada	*Central/Prairies*
University of British Columbia	University of Calgary
Vancouver Hospital and Health Sciences Centre	(and 3 surrounding colleges, Olds,
University of Northern British Columbia	Red Deer, and Mount Royal)
Ontario	*Québec*
York University	Université de Laval
University of Ottawa	École Polytechnique
University of Western Ontario	Université de Sherbrooke
Ryerson University	
Lakehead University	*Atlantic Canada*
University of Guelph	University of PEI
Queen's University	Dalhousie University
	Memorial University

For mini-case studies of networks, interviews were conducted with the Executive Directors of the networks, representatives from 2-3 organizations that hosted interns, and 2-3 intern graduates. The host organizations and graduate interns represented the full spectrum of technology transfer offices, venture capital firms, and technology companies. Exhibit 2.3b identifies the networks that participated in the mini-case studies and the organizations consulted in the interview process.

Exhibit 2.3b – Organizations Participating in Network Mini-Case Studies

Network	*Organizations Consulted*
WestLink Innovation Network	University of Northern British Columbia University of Calgary University of British Columbia 3 Host Organizations (names withheld)
InterVal Network	University of Sherbrooke Laval University École de Technologie Supérieure, Université du Québec Univalor MSBi Capital
BioDiscovery Toronto Network	Mount Sinai Hospital Toronto General Hospital University Health Network Receptor (name withheld)

Key findings from the mini-case studies are presented in the main body of this report, with only the most relevant data referenced for this evaluation issues.

Online survey

An online survey was conducted with representatives from institutions funded by the IPM Program, recipients of technology transfer training, researchers active in technology and knowledge transfer, and IP receptors. The assistance of TTO/ILO Directors was solicited to develop a list of stakeholders. In all, five distinct questionnaires were employed to gather data from the following stakeholders:

- Directors of technology transfer offices (or equivalent);
- Vice Principals of Research (or equivalent);
- Recipients of training;
- Researchers involved in technology and knowledge transfer; and
- Representatives from organizations that acted as receptors of research.

The five questionnaires were tailored to the respondent groups but also included common questions to allow for comparison of responses across groups.

A census approach was used to survey TTO/ILO Directors and VPs of Research at institutions in Canada; however, Directors of TTOs/ILOs and VPs of Research that participated in the mini-case studies were not asked to complete the online survey. This approach was followed to ensure data was captured from a wide range of institutions, and at the same time, keep stakeholder response burden to a minimum. Because a list of recipients of training, researchers involved in technology and knowledge transfer, and IP receptors was not available, the evaluation used a snowball approach to develop a survey frame for these respondents. To develop the frame, TTO/ILO Directors were asked in March 2007 to provide a list of these stakeholders. Directors forwarded contact information for approximately 700 stakeholders to the evaluation team.

The survey was initiated in mid-July 2007 with an email invitation sent to all potential respondents, containing a link to the survey website. Potential respondents were provided with a user name and password so that they could enter and re-enter the survey questionnaire if needed. Three reminders were sent in the months of August and September to boost response rates. The survey was closed in late September 2007. A total of 359 questionnaires were completed, representing a response rate of 43.3%. The breakdown by respondent group is presented in Exhibit 2.4.

Exhibit 2.4 – Evaluation Survey Frame and Response Rates

Survey Type	Frame Size	Completed	% Complete
VP Research	75	34	45.3%
TTO Directors	61	41	67.2%
Researchers	425	176	41.4%
IP Receptors	204	69	33.8%
Trainees	64	39	60.9%
Total	829	359	43.3%

Comparison of federal, provincial, and regional programs

A comparison was conducted of programs that offer complementary or potentially overlapping support to IPM stakeholders in order to understand the environment in which the IPM program operates, its attribution to observed changes in the environment, and inform its future design. This list was not

meant to be exhaustive, but rather reflected programs identified as having the potential to overlap with the IPM program. The comparison was conducted via a review of program websites and telephone interviews with program staff for eight programs.

Federal Granting Agency Programs
Proof of Principle (POP) (CIHR)
Idea to Innovation (I2I) (NSERC)
Commercialization Management Grant (CIHR)
Knowledge Impact in Society (SSHRC)
Indirect Costs Program (Tri-council)

Ministry of Research and Innovation Ontario
Ontario Research Commercialization Program
Ontario Commercialization Investments Funds Program
Innovation Demonstration Fund
Business Investment Program

Québec Ministry of Economic Development, Innovation, and Export Trade
Maturation Technologie Economique

Regional Economic Development Programs
Western Diversification Program
Atlantic Innovation Fund

2.5 Data Limitations and Reliability

Certain limitations and reliability of data gathered in the evaluation must be noted. First, prior to the launch of the evaluation's survey, the community of technology transfer/industry liaison offices in Canada was estimated to comprise approximately 60-70 offices. Over the course of administering the survey to technology transfer offices, representatives from approximately 5 universities and hospitals informed evaluators that they could not complete the survey, as they had not received IPM program grants and did not conduct technology transfer activities. In addition, a few offices preferred to report through larger partner universities or hospitals. As a result, the number of TTOs/ILOs across Canada is lower than originally thought at approximately 55. Given such a small frame of offices, survey data for some groups of respondents could not be disaggregated for comparison across regions.

Second, in conducting the mini-case studies, it became apparent that the TTOs/ILOs at some universities and hospitals have experienced considerable turnover in recent years. For some offices that participated in the case studies, there were no individuals working in these offices that had been employed during the time period of the early IPM grants (i.e., 1995 and 1998) and could speak to the impact of these grants on the office. In these cases, the evaluators had to rely solely on the reports submitted to IPM management to assess the impact of early IPM grants, and reports and interviews with Directors to assess the impacts for more recent IPM grants. As a result, these cases did not provide the same level of detail and context regarding IPM impacts as the cases that featured the review of reports and interviews with long standing Directors. Accordingly, the evaluation has "weighted down" the impacts described in the earlier reports, as these impacts could not be discussed with and verified by TTO/ILO Directors, and only included evidence of impacts in the evaluation report that could be verified by TTO/ILO Directors.

Third, the extent to which the evaluation is able to assess the impact of the IPM program on TTO/ILO technology and knowledge transfer activities is limited by two methodological difficulties which arose during the course of evaluation. First, IPM funding represents one of many sources of funding that support TTOs/ILOs which means that the precise impact of IPM funding

cannot be quantified. Second, the variant nature of the definition of knowledge transfer, the fact that knowledge transfer activities are in the early stages of development as well as the lack of baseline and quantitative measures for knowledge transfer made it difficult for the evaluation to assess the precise impact of program funding on knowledge transfer activities.

Fourth, the validity of the evaluation's findings are challenged by the fact that two key lines of evidence (online survey and mini-case studies) for the evaluation rely on the responses of stakeholders who have received IPM funding and, as such, may be biased. For instance, stakeholders at institutions that received IPM funding may be inclined to respond to questions in a manner that improves their likelihood of continued funding. For example, there may be a tendency of some stakeholders to overstate the need for or the impacts of the IPM program. To avoid biased responses during the mini-case study interviews, evaluators probed respondents to provide examples that supported statements that they made. The responses of online survey stakeholders were compared with those participating in mini-case studies to identify any significant divergence in responses for key issues.

Finally, only one representative from SSHRC was interviewed during the conduct of key informant interviews. As a result, the responses of this person may not necessarily be representative of the views and opinions of SSHRC regarding the IPM program.

3.0 Evaluation Findings

This section provides the evaluation findings for issues of relevance, results, and cost effectiveness.

3.1 Relevance

Issue 1: Is there a continuing need to support technology and knowledge transfer infrastructure at universities, research hospitals, and colleges?

Finding 1: Canadian institutions continue to need support for several reasons. Research funding and activity has increased significantly in recent years and institutions are placing more emphasis on commercializing the results of this research. These changes have led to a sharp increase in the number of invention disclosures that technology transfer offices must evaluate, as well as the number of patents, licenses, industry partners and receptors that must be managed. To be able to respond to the result of this increased research activity, offices will need to hire additional staff, and ensure that they have the required expertise to be effective. But the budgets of Canadian institutions are very tight, they have no additional funding that can be directed toward technology transfer offices, and most offices have yet to develop healthy commercialization revenue streams.

Issue 1a: What are the significant obstacles?

Finding 1a: The most significant obstacle to successful technology and knowledge transfer is the small or tight operating budgets of TTOs/ILOs. As a result, many TTOs/ILOs do not have enough licensing officers to operate as effectively as they could, and there is insufficient funding to train them to be more effective in their roles. There is a perception among some interviewees that highly skilled technology transfer personnel are found in only a handful of Canadian institutions. Many promising inventions are never commercialized because there is not enough money available to advance them to the point in which they would attract the interest of industry or qualify for program

funding. For instance, NSERC's Idea to Innovation (I2I) program and CIHR's Proof of Principle (POP) program require an innovation to be considerably further along in the development process than an innovation at the point of invention disclosure. Finding partners is challenging for institutions because private sector firms in Canada tend to be small, inexperienced in technology transfer, and lack investment capital. Finally, according to some TTO/ILO Directors and VPs of Research, there are some researchers at Canadian institutions that are ambivalent or opposed to commercializing their research results.

A number of significant obstacles stand in the way of transferring knowledge and technology from Canada's academic institutions to the public and private sector. The most significant obstacle is a lack of sufficient funding for TTOs/ILOs. Mini-case study findings indicate that the budgets of TTOs/ILOs are generally small and stretched. Mini-case studies found that TTOs/ILOs at small and medium universities typically operate on annual budgets of $200-$500K, and a few TTOs/ILOs at large institutions have annual budgets well under $1M. Commercialization revenues accrue mostly to large, well-established offices. Three mini-case study participants have annual commercialization revenues of less than $500K (two large and one medium institution), while another five (two medium and three small institutions) report no revenues. Additionally, for several offices, revenues are retained in general university accounts, rather than flowing back into the TTO/ILO.

The challenging funding situation at academic institutions can impact two key areas of operation. First, TTO/ILO Directors and researchers reported a lack of funding to develop promising inventions as the most significant challenge to successful technology and knowledge transfer. VPs of Research ranked it as the second most significant challenge. Interviews held with TTO/ILO Directors and researchers at institutions that participated in the mini-case studies revealed that there is little or no funding to further develop promising inventions to a point where they have a realistic chance of obtaining the highly desirable but very competitive funding from NSERC's Idea to Innovation (I2I) program and/or CIHR's Proof of Principle (POP) program. This may help explain the relatively poor take up of the I2I program. According to mini-case study interviewees, many potentially promising inventions die in this gap

because limited funding is directed toward even more pressing priorities, such as increasing human resources and skills.

Second, many TTOs/ILOs lack sufficient staff. For instance, the mini-case studies revealed that:

- One institution has nearly $100M of research expenditures annually, but its technology transfer office has only 2.0 licensing full time equivalents (FTEs);
- Several institutions have 3 or fewer licensing FTEs in their offices; and,
- Until recently, one institution had no dedicated technology transfer officer in its member hospitals to solicit and evaluate invention disclosures from researchers.

The evaluation also found that TTOs/ILOs could be more effective if they had more highly skilled staff. A lack of staff and a lack of highly skilled staff prove to be obstacles in several ways. For example, it can mean researchers are unable to disclose their inventions in a timely manner; a promising invention may not receive appropriate attention; or an invention with limited potential may be mistaken for one with very good potential. As illustrated in Exhibit 3.1, a lack of staff is of particular concern to Directors and VPs of Research. The limited expertise of office personnel is viewed to be a significant obstacle by both researchers and IP receptors (although researchers report it to be more significant). Over one-half of VPs of Research and one-third of TTO/ILO Directors point to a lack of funding to train staff as an obstacle.

Exhibit 3.1 – Potential Obstacles to Successful Technology Transfer Inherent to TTO/ILOs

	Percentage of Survey Respondents Reporting the Obstacle is Very Significant/or Significant		
	Lack of Staff	Limited Expertise of TTO/ILO Personnel	Lack of Funding to Train Staff
TTO/ILO Directors	18.2%/ 57.6%	N/A	9.1%/27.3%
VPs of Research	40.0%/40.0%	N/A	23.3%/33.3%
Researchers	18.9%/29.9%	17.7%/29.9%	N/A
IP Receptors	6.8%/30.5%	10.2%/23.7%	N/A

Key informant interviews also supported the findings of the online survey. Two of five members of the IPM review committees reported that some offices lack personnel with the skills required to be effective at technology transfer.

A disconnect between some members of the research faculty and industry is also an obstacle. A misunderstanding of receptor needs by researchers was reported to be either a very significant or significant obstacle by nearly half of IP receptors that completed the evaluation survey. Furthermore, 42% of researchers admitted that their lack of understanding of receptor needs was a significant or very significant obstacle. This finding was reinforced in comments made by some key informant interviewees that suggested that offices tend to push one-off technologies that on their own are not particularly attractive to industry. On this point, interviewees indicated that TTOs would be more effective at attracting industry if they were to bundle technologies.

The funding problem extends beyond the institutions, however. A lack of funding in the private sector for commercialization efforts was identified as a significant challenge by 65% of IP receptors. This finding was corroborated by some key informants who stated that developing new technologies is expensive and that there is a relatively small pool of venture capital in Canada. In addition, researchers, VPs of Research and TTO/ILO Directors interviewed during the mini-case studies conveyed that in their experience, firms in Canada are relatively small, and lack the know how required to conduct successful technology transfer. This finding is consistent with the Government of Canada's science and technology strategy, which states "Canada has a greater number of small firms relative to our competitors such as the United States. Smaller firms often have more difficulty financing and managing R&D and adopting new technology.[5]" This problem is particularly acute in Atlantic Canada according to mini-case study participants, and pointed out in a report on the economic impact of universities in the Atlantic provinces.[6] These findings are supported by the survey findings in which 46% of TTO/ILO Directors, 73% of VPs of Research, and 63% of researchers reported the obstacle to be significant or very significant (versus only 19% of IP receptors).

[5] Mobilizing Science and Technology to Canada's Advantage, Canadian Government, p. 27.
[6] "Smarter Together – The Economic Impact of Universities in the Atlantic Provinces, March 2005, pg. 8

These challenges may explain the relatively higher rate of university spin-offs created in Canada versus the USA, as described in the AUTM annual survey.

Finally, the evaluation found some evidence to indicate that a portion of researchers is either ambivalent toward or opposed entirely to commercializing research results. The evaluation survey revealed that reluctance by researchers to commercialize research was identified as a significant obstacle by 52% of TTO/ILO Directors and 33% of VPs of Research. Furthermore, an additional 3% of Directors and 23% of VPs of Research reported this obstacle was very significant. Related to this, key informants and mini-case study participants perceive that the share of researchers opposed to commercializing research tends to be older, approaching retirement, and is increasingly being replaced by younger researchers who are more accepting of commercializing research.

Issue 1b:What kind of support is needed?

Finding 1b: TTOs/ILOs need additional funding to be more effective. In particular, they need to be able to train and hire more staff to accommodate the disclosure volume that flows from rising levels of research activities at Canadian institutions. More and better-trained staff is required to effectively evaluate research disclosures, conduct outreach activities to industry, and network with other TTOs/ILOs. Researchers need funding to conduct more demonstration or pilot projects so that promising inventions are not lost in the innovation gap.

Additional funding is a first step in improving the effectiveness of TTOs/ILOs. TTO/ILO Directors reported in the evaluation survey that the following activities were priorities for their offices in the near future: marketing and outreach activities; demonstration projects; hiring more TTO/ILO staff; participating in networks; patenting; and training personnel. All these activities have cost implications. Findings from case study interviews conducted with Directors are consistent with the survey findings - funding is needed to hire more staff, support networking, conduct outreach to researchers, and to improve the skills of TTO/ILO staff. For example, outreach to researchers is important because the process of turning an idea or technology

into a marketable product is not obvious to many researchers, so the TTO/ILO must therefore educate researchers on the process and guide them accordingly. For small offices, conducting sufficient outreach activities with only one or two officers is challenging.

Mini-case studies found that networking is particularly important for TTOs/ILOs at small institutions because it enables them to access the expertise, advice, and administrative support found at offices at larger institutions. For example, mini-case study findings of TTOs at two small Atlantic universities identified a particular need for funding for networking. Interviewees reported that networking is particularly important for offices with few staff, as networking provides them access to the expertise, advice, and administrative support found at larger and more sophisticated offices.

The skills of office staff can be improved by either courses delivered by AUTM or ACCT, or internship training programs. Internship training programs increase the pool of personnel with the skill set desired by institutional TTOs/ILOs, venture capital firms, and technology companies. Interviews with host organizations associated with two internship programs revealed that they very much value the services provided. Specifically, they feel that the networks do a much better job than they could do in finding high quality interns, and the internships provide an opportunity for offices to evaluate a candidate at low cost (intern salaries are partially offset by the network) with no obligation. In addition to solving short term staffing needs, 75% of graduates at one network and 33% of graduates at another network are now working full time in institutional technology transfer offices.

Pilot or demonstration projects, which are specifically aimed at bridging the innovation gap were a relative rarity among institutions participating in the case studies. Only three case study participants requested and used IPM funding for demonstration projects. The impression left with evaluators was that offices wanted to direct funding toward demonstration projects, but improving human resource capabilities (hiring and training), took precedence. For example, a mini-case study participant revealed to evaluators that when their IPM grant was approved for less than the amount requested, they were forced to make a tough decision between hiring fewer officers than planned or cutting the demonstration projects altogether. TTO/ILO Directors that were

surveyed identified demonstration projects as the fourth most important area for support.

Surveyed TTO/ILO Directors identified having sufficient human resources to solicit and evaluate invention disclosures as the fifth most important support area . Discussions with several TTO Directors in conducting the mini-case studies revealed that research expenditures have risen sharply at many universities in recent years (e.g., at one institution, research expenditures have risen from $90 million in 1999 to $240 million in 2006). Such sharp increases have over time led to increased invention disclosures, placing pressure on existing TTO/ILO staff to handle the demands of researchers. Institutions generally lack the finances to increase staffing levels in their commercialization offices in response to increases in research activity. In conducting one mini-case study, it was revealed that representatives from the network undertook a study that demonstrated that the relatively low commercialization rate of the local area hospitals compared to the Canadian and American average was the result of sharply lower staffing levels in their technology transfer offices. The study was appended to the IPM application submitted by the network, requesting funding to establish a commercialization officer in each of its member hospitals.

Issue 1c: What challenges exist in obtaining the right personnel?

Finding 1c: TTOs/ILOs face several challenges to obtain the right personnel. There are not a great deal of people with the right mix of business and scientific skills, and the salaries offered by TTOs/ILOs are generally lower than those offered by the private sector. Instability surrounding TTO/ILO funding poses a significant challenge. University and hospital budgets lack the funds to hire additional technology transfer staff. Offices therefore rely on provincial or federal program grants to hire or retain staff; however funding terms are often 2-3 years in length, meaning that valuable personnel are lost when funding ends.

The evaluation found that TTOs/ILOs face a challenge recruiting the right personnel because people with the right mix of relevant business experience

and scientific knowledge are relatively rare. The mini-case studies revealed that finding junior people with this mix is difficult. For example, a senior representative from a large Ontario university stated, "when it comes to business school graduates, there is confusion between entrepreneurship and technology transfer", meaning that business school graduates need specific additional training to be effective in technology transfer. These findings echo the Government of Canada's science and technology strategy which indicates that Canada needs more people with both science and business skills in order to draw knowledge from within research institutions and create innovations for the marketplace.[7] The strategy also states that "Canada's private sector does not provide strong enough incentives for students to strive for advanced S&T and business management skills" and "hire fewer university graduates as a percentage of their workforce than do their counterparts in the United States."[8]

Another challenge in recruiting and retaining the right people are the uncompetitive salaries offered by TTOs/ILOs when compared to the salaries offered by the private sector. Key informants and TTO Directors interviewed for the mini-case studies stated that commercialization officers quickly become very attractive to venture capital and technology firms once they gain sufficient experience. They are often lured away by much higher salaries. Furthermore, the mini-case studies revealed that small offices face the disadvantage of being unable to offer the attractive career paths of larger offices.

The instability surrounding the funding situation also poses a challenge for TTOs/ILOs to retain the right personnel. Interviews with VPs of Research and TTO/ILO Directors who participated in the mini-case studies revealed that the offices use provincial and federal grant funding to hire personnel and the terms and conditions of these grants mean that they can only commit to new hires for short periods of time (maybe 2-3 years). For example, a large Quebec university has a very valuable officer that has greatly increased the invention disclosure rate at the university, but is in danger of losing the officer when the IPM funding that supports the position's salary ends next year. Understandably, turnover in TTOs/ILOs can be high. The evaluators found it

[7] Canada. Industry Canada. Mobilizing Science and Technology to Canada's Advantage, 2007, p. 31.
[8] Ibid.

surprising that offices managed to keep such highly skilled people in such an uncertain working environment.

Despite these challenges, the quality of senior staff, particularly TTO/ILO Directors is extremely impressive. Many Directors have backgrounds that span academia, venture capital, and technology start-ups. It is apparent that many have foregone higher salaries elsewhere in favour of the lifestyle offered by working at academic institutions or they simply have an unwavering commitment to technology and knowledge transfer at Canadian academic institutions. It may also be that personnel place a high value on the experience they gain working in university TTOs.

Issue 2: How does the IPM program fit into the environment in which it operates? How has this environment evolved over time since the inception of the IPM program? How is this environment expected to evolve?

Finding 2: Despite an increasing number of federal, provincial, regional, and municipal programs aimed at increasing the commercialization of institutional research, in recent years, the IPM program remains relatively unique. It is the only program offered to institutions across Canada that is specifically designed to support technology transfer office infrastructure. Its small project support to develop promising researcher technologies beyond the idea stage is critical, but often goes unfunded because there are even more pressing priorities. Its redesign in recent years to encourage networking seems timely given that collaboration with universities, hospitals, colleges, and centres of excellence is expected to become more important and prevalent in the future. Its continued support of human resources at technology transfer offices is also critical and appropriate in light of sharply rising levels of research being conducted at universities, hospitals, and colleges. As technology transfer offices become increasingly sophisticated, it is likely that the number of offices that operate externally to institutions will increase, as they offer certain advantages over offices housed internally.

Issue 2a: What are the other sources of funding available?

<u>Finding 2a:</u> Findings from the survey indicate a wide divergence between the current and preferred levels of support from funding sources for TTO/ILO budgets. For example, TTO/ILO Directors surveyed reported that over half (57%) of TTO/ILO funding comes from institutional general operating funds; however, VPs of Research surveyed would, on average, prefer their institutions to account for about 14% of TTO/ILO budgets. VPs of Research that responded to the survey would also prefer IPM funding to account for about 17% of their budgets, rather than the current 3.7% reported by TTO/ILO Directors.

There are several other funding sources available to TTOs/ILOs, such as federal, provincial, regional, and municipal programs, overhead surcharges to industry partners who sponsor research, and commercialization revenues. The relative importance of these sources in an office budget can vary widely. For small offices, institutional operating funds account for most of the budget and commercialization revenues are often non-existent. At the other extreme, some large offices generate significant commercialization revenues; however, these revenues often flow back into general accounts of the university.

Findings from the mini-case studies revealed wide discrepancies in the size of TTO/ILO budgets across universities, with budgets in the seven-figure range for large universities, the mid six-figure range for medium size universities, and lower for small universities. These findings were supported by the survey, where Directors of TTO/ILOs at small universities reported budgets of $140K on average, $260K on average at medium size universities, and $3.3M on average, at large universities. The TTO budgets of small universities represent the highest proportion of research revenues, attesting to the fixed costs and smaller economies of scale associated with operating a small technology transfer office.

Surveyed TTO/ILO Directors were asked to identify the amount and percentage of the sources of financial support for their offices in most recently completed fiscal year. Findings revealed that the largest single source of funding for their office remains the baseline operating funds provided by the university or hospital, which accounted for, on average, 57.0% of their funding. Surveyed VPs of Research were asked to identify what proportion of TTO/ILO budget support should come from the sources of support presented in

Exhibit 3.2. VPs of Research indicated in the survey that institutional baseline funding should account for only 14.2% of the TTO/ILO budget.

Exhibit 3.2 – Actual TTO/ILO Budget Breakdown Compared with VP Research Preferences

Source of TTO/ILO Funding	Actual Funding Reported by TTO/ILO Directors (n=26)	Preferred Funding Reported by VPs of Research (n=24)
Baseline operating funds	57.0%	14.2%
Federal Indirect Costs Programs	11.7%	13.9%
Provincial programs	8.7%	15.8%
Federal Regional Economic Development Programs	8.4%	17.8%
Revenues from commercialization activities	8.2%	13.8%
IPM Program	3.7%	16.6%
Other	1.5%	N/A
Municipal / local-regional programs	0.5%	1.8%
Institutional surcharges (overhead)	0.4%	6.1%
Total	100.0%	100%

TTO/ILO Directors that responded to the evaluation survey reported that the Indirect Costs Program was the next largest source (11.7%), but the amount of Indirect Cost funding that finds its way into TTO/ILO budgets varies considerably across institutions. VPs of Research report that funding from Indirect Costs Program accounts for a smaller share of the budget than they would prefer (11.7% versus 13.9%).

The mini-case studies revealed that funding from the Indirect Cost program can be very small and often not disaggregated from general institutional funding. Survey data reported by TTO/ILO Directors revealed that approximately $1,540,942 in Indirect Costs program funding found its way into the budgets of 12 TTO/ILOs. This funding represented 6.7% of the total Indirect Cost Program funding that these institutions received in 2006/07, supporting the contention of TTO/ILO Directors that only a small share of Indirect Cost Program funding finds its way into the budgets of technology transfer offices. The remaining 13 offices that provided budget breakdowns reported zero funding from Indirect Costs suggesting that their institution had not directed Indirect Cost program funding to the office or that the funding was rolled into general institutional funding for the office and reported under “baseline operating funds”. These findings are consistent with a third year review of the

Indirect Costs program completed in January 2006, which reported that 6% of program funding to institutions were used to manage intellectual property in 2003/04.

TTO/ILO Directors report that funding from provincial programs (8.7%), federal regional economic development programs (8.4%), other sources (1.5%) and municipal programs (0.5%) account for relatively small shares of budgets; however, offices can use funding from these sources in a number of ways. For example, CIHR's Commercialization Management Grant program can be used to hire recent MBA graduates; offices located in Ontario can use funding from the Ontario Research Commercialization Program (ORCP) to hire staff; and offices located in Western and Atlantic Canada can use the Western Economic Diversification (WED) program and the ACOA's Atlantic Innovation Fund (AIF) respectively to support activities. Actual funding from provincial programs and federal regional economic programs is about half the share of office budget preferred by VPs of Research (8.7% versus 15.8% and 8.4% versus 17.8%, respectively). For funding from municipal programs, the preferred amount is 1.8%; over three times the actual level.

Findings from the survey of TTO/ILO Directors revealed that commercialization revenues from 20 responding offices accounted for, on average, 8.2% of budgets, and have increased 9.4% over the last five years. Despite the increase, the proportion of funding is considerably lower than the preferred amount of 13.8% indicated by VPs of Research. It should be noted that the mini-case studies revealed that significant commercialization revenues accrue only to large and well-established offices. Furthermore, in many cases, the revenues flow back into general university accounts rather than into the TTOs/ILOs. As one Director from a large TTO with over $1M in licensing revenues last year stated "I would be happy to see just 15% of our licensing revenue returned to the office".

On average, the IPM program accounted for just 3.7% of the TTO/ILO budgets according to TTO/ILO Directors who responded to the survey, which is much lower than the preferred proportion of 16.6% identified by VPs of Research. For the TTO/ILO Directors that responded, IPM funding accounted for 26.5% of TTO/ILO budgets at small universities, 13% at medium size universities, and 2% at large universities. Consistent with the survey findings, the mini-case

studies revealed that IPM funding varies by size of institution. IPM accounted for on average, 22.8% of budgets at small universities, 18.1% of budgets at medium sized universities, and 4.7% of budgets at large universities. When the survey responses (26 TTO/ILOs) are combined with results from the mini-case studies (17 TTO/ILOs), the share of annual TTO/ILO budgets accounted for by IPM was on average 5.1%. Please refer to Exhibit 3.3 below.

Exhibit 3.3 – IPM Funding as a Share of TTO/ILO Budgets

	IPM Funding as Share of Budget		
	Case Studies	Survey	Overall
Small	22.8%	26.5%	24.7%
Medium	18.1%	13.0%	15.6%
Large	4.7%	2.0%	3.3%
Total	**6.3%**	**3.7%**	**5.1%**

Other Sources of Support for Commercialization

There are also a few programs that are peripheral to programs directly supporting technology transfer offices and researchers. The Ontario Commercialization Investment Funds program leverages seed capital for spin-off technology companies created by faculty, staff or students of research institutes; the Knowledge Impact in Society Program, a pilot program by SSHRC supports effective knowledge exchange and mobilization; and the Ontario Government's Business Investment Program matches SME business needs with academic research teams who work in collaboration to achieve R&D objectives.

In addition, NSERC's I2I program and CIHR's POP program provide funding for researchers to further develop promising technologies. At the provincial level, a component of the ORCP provides funding for early stage proof of principle initiatives. Often, demonstration project funding (offered by IPM) is necessary however, to advance a promising invention to the point where it could have a realistic chance of winning an I2I or POP grant, as they fund technologies that are further developed and have attracted industry partners.

Issue 2b: Do other funding sources overlap with the IPM program, and if so, how does this impact the IPM program? How do other programs dovetail with the IPM program?

<u>Finding 2b:</u> The ORCP, WED and AIF programs overlap with IPM in the support of salaries for personnel. Activities covered under these programs are cost shared with IPM, and support from these programs is required for TTO/ILOs to have sufficient operating budgets.

Key informants, Directors of TTOs/ILOs and VPs of Research consider the IPM program to be unique. It is seen as the only Canada wide program that focuses on building institutional technology and knowledge transfer capacity. For instance, it is the only program available to TTOs/ILOs right across Canada that provides funding directly to technology transfer offices to assist them in addressing their most pressing needs such as hiring and training staff.

Other programs only offer a small part of what IPM offers, therefore program overlap with IPM tends to be small, but it does exist. The mini-case studies also revealed that offices need to access funding from many different programs in order to cover their operating costs. The evaluation found the following instances of overlap:

- The CIHR Commercialization Management grant can be accessed when staffing new positions in a TTO/ILO. The CIHR program can only be used however, to hire recent MBA graduates, therefore if the preferred candidate does not hold an MBA, or is not a recent graduate, the candidate must be hired using the IPM program or some other source of funding;
- The ORCP also offers support to hire personnel, and offset patent costs; and,
- Offices in Western provinces can use the WED program and offices in the Atlantic provinces can use the AIF program for personnel and professional consultation costs.

The Indirect Costs program does not overlap with IPM and instead, serves as a complementary source of funding for TTOs/ILOs. The Indirect Costs program outline for instance, states that intellectual property management costs already covered under other federal initiatives are not eligible for funding. The program is intended to support incremental activities rather than replace

existing funding, and is a fairly flexible funding source that can be used to cover a variety of indirect costs.

The CIHR POP, NSERC I2I, and Ontario and Quebec provincial programs supporting proof of principle projects do not overlap with IPM, as they fund technologies that are much more developed than the pilot or demonstration projects funded by IPM.

Key informants feel that a specific program such as IPM is needed to ensure that the funding goes to where it is needed most. In particular, they are concerned that if the IPM were to be managed by another federal program, such as the Indirect Cost Program, then the funding may be used for activities other than technology and knowledge transfer. There are no other obvious organizations (other than the federal granting agencies) to play a lead role, as the private sector is too diverse and spread out. The NSERC/CIHR/SSHRC peer review process is also perceived to be a real strength of the IPM program.

Issue 2c: What are the different organizational structures that different institutions use? How do attitudes to, cultures of, and objectives of technology and knowledge transfer differ across institutions?

Finding 2c: Only about 10% of institutions use the services of a separate legal entity rather than house an internal TTO/ILO. As institutions become more established and sophisticated in their technology transfer activities, and commercialization revenues increase, the number of institutions that establish separate legal entities may increase. Regardless of whether offices are internal or external to the institution, the mandates of offices are relatively consistent. The mandates typically focus on supporting researchers and transferring knowledge and technology to the public and private sector with an emphasis on social benefits. The commercialization focus can be somewhat stronger however, at TTOs/ILOs that are not part of the university structure.

Of the 33 institutions that completed the survey and the 17 institutions that participated in the case studies, 45 or 90% have chosen to locate their TTO/ILO in their institution, typically in the office of research. Five

institutions (10%) have chosen to spin out the office from their institution as a separately incorporated entity. An examination of the 2004 IPM survey reveals that the number of TTOs/ILOs operating outside of institutions has remained relatively constant. The 2004 survey was also completed by 50 institutions, of which 6 used a separate legal entity to conduct technology transfer activities. Since the 2004 IPM survey was conducted, one institution has dissolved its external technology transfer company and brought technology transfer activities back into the institution.

Due to IPM funding, a number of small institutions have been able to designate a full time employee to a technology transfer officer position in recent years. These officers often rely on the services of larger institutions located nearby to offer a full suite of technology transfer services to researchers and industry partners. The evaluation survey revealed that six institutions (12%) use the services of another institution's office. This information was not collected in the 2004 IPM survey.

The findings from the mini-case studies and surveys suggest that there is no one "right model" for technology transfer. The chosen structure is often a factor of the VP Research's personal preferences, and the sophistication and history of technology transfer at the institution. For example, two mini-case study participants created separately incorporated entities to handle technology transfer activities.

A number of pros and cons exist for TTOs located inside institutions versus those that are separately incorporated. The pros of keeping the office inside the institution consist of VP Research control over the operations, and better access to researchers, while the cons are the institution tends to be more exposed to lawsuits, and salaries for commercialization officers have ceilings which present recruitment and retention challenges. Offices that are established as separate legal entities enjoy quicker decision-making, as the VP Research needs to be consulted less (or not at all), more integration with industry/receptors, some protection from lawsuits for the university, and more salary flexibility. Separately incorporated entities are also more likely to reach out beyond the university and engage in the commercialization of discoveries made by inventors in the community.

Some institutions that participated in the mini-case studies have separated activities such as disclosure reception and evaluation from administration, human resources, and IP management. In Quebec, at least two mini-case study participants leave spin-off development and market evaluation to a separate company operated at arm's length from the university; however, commercialization revenues flow back to the university nonetheless. An Atlantic university has also adopted this approach.

Generally, the mini-case studies demonstrated that separately incorporated offices tend to exist at institutions with a long history of commercialization and strong revenues. This finding would seem to suggest that as Canada's technology transfer offices become more established, the number of institutions that spin these services out into a separately incorporated entity may increase. For example, findings from the mini-case studies revealed at least two institutions where the Director and VP of Research were contemplating such a move in the future when commercialization revenues are sufficient to do so.

The mandates of TTOs/ILOs, as revealed in the survey and mini-case studies are fairly consistent across institutions. Typically, the mandates focus on supporting researchers, reaching out to industry, and transferring technology and knowledge to the private and public sector with economic and social benefits for Canadians. All institutions place an emphasis on technologies that have social or health benefits. TTO/ILO Directors and VPs of Research stressed that success should not be based entirely on commercialization revenues; however, offices that are separately incorporated from their institution appear to have more of a focus on commercialization revenues.

3.2 Impacts/Results

Issue 3: To what extent are the objectives and outcomes of the IPM program being achieved? To what extent can these outcomes be attributed to the program itself?

Finding 3: *Recent Statistics Canada and AUTM data indicate that commercialization of research results at Canadian institutions has more than doubled in the last seven years. These findings are supported by the evidence from the mini-case studies and survey; however, the extent to which this progress is attributable to IPM varies across institutions. At small TTOs/ILOs, where IPM has represented a significant share of the office budget, IPM funding has greatly improved office capacity by providing salary support for professionals. In some cases, the funding has meant the difference between having a dedicated full time technology transfer resource and not having one at all. By using IPM funding to participate in networks, small institutions have become more effective, by being able to access the experience and expertise of larger, more sophisticated technology transfer offices.*

At medium size institutions, the program has built capacity by providing offices with funding to hire additional technology transfer officers to solicit and evaluate more invention disclosures. At large institutions, the program has helped to build capacity by providing salary support for additional officers, and providing funding for new initiatives such as entrepreneur in residence programs and venture capital activities.

IPM funded internship training programs have been effective at providing institutions of all sizes with highly trained candidates for positions within TTOs/ILOs. Furthermore, some graduates are now working at venture capital and technology firms, which have made for a more networked group of professionals that helps to support technology transfer.

The program's impact on knowledge transfer appears to be less significant however, than its impact on technology transfer.

Issue 3a: To what extent is there evidence of increased knowledge and technology transfer?

<u>Finding 3a:</u> The evaluation survey data, combined with survey data from Statistics Canada and AUTM demonstrate that more technology is being transferred today than a few years ago, as evidenced by figures for active licenses, institutional spin-offs, and commercialization revenues. About 20% of TTO/ILO Directors report that IPM has had a significant impact on their

institution transferring more technology to the user sector, and another 41% report the impact as moderate. Evidence of increased knowledge transfer is difficult to quantify, as the area lacks the metrics of technology transfer. The program's impacts appear to be less significant in the area of knowledge transfer. However, it should be noted that this is a relatively new area for the program, with funding for knowledge transfer activities only available since 2005.

Exhibit 3.4 presents patent and commercialization data from 19 institutions in the evaluation survey that provides evidence that more technology is being transferred now than five years ago. The survey data demonstrates that there have been significant increases in the number of patents and active licenses held, and the number of institutional spin-offs, while licensing income has increased at a more modest rate.

Exhibit 3.4 – Patent and Commercialization Statistics of Responding TTO/ILOs

	Five Years Ago	Today	% Change
Patents held	477	1714	259.3%
Active licenses	557	1074	92.8%
Licensing income	$9.7M	$10.6M	9.3%
Institutional spin-offs	51	166	225.5%

Source: TTO/ILO Director Survey

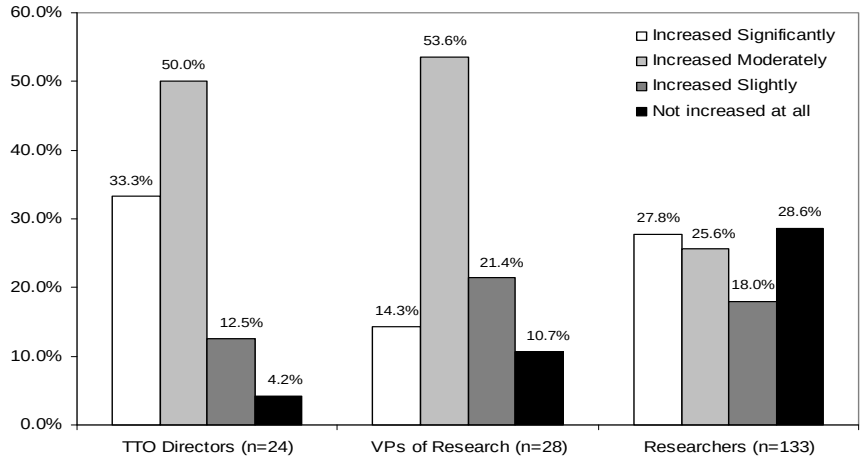
Findings from recent Statistics Canada and AUTM surveys, which cover a broad number of Canadian institutions, demonstrate that there has been a significant increase in technology transferred in recent years. Statistics Canada reports that the number of new licenses and options, active licenses, and income from IP commercialization, increased 148.7%, 99.8%, and 161.1% respectively from 1999 to 2005.[9]

The extent to which knowledge transfer has increased is more difficult to measure. Unlike technology transfer, there are few statistics collected. Directors and VPs of Research were asked in the evaluation survey to what

[9] Statistics Canada, 1999-2005 Survey of Intellectual Property Commercialization in the Higher Education Sector

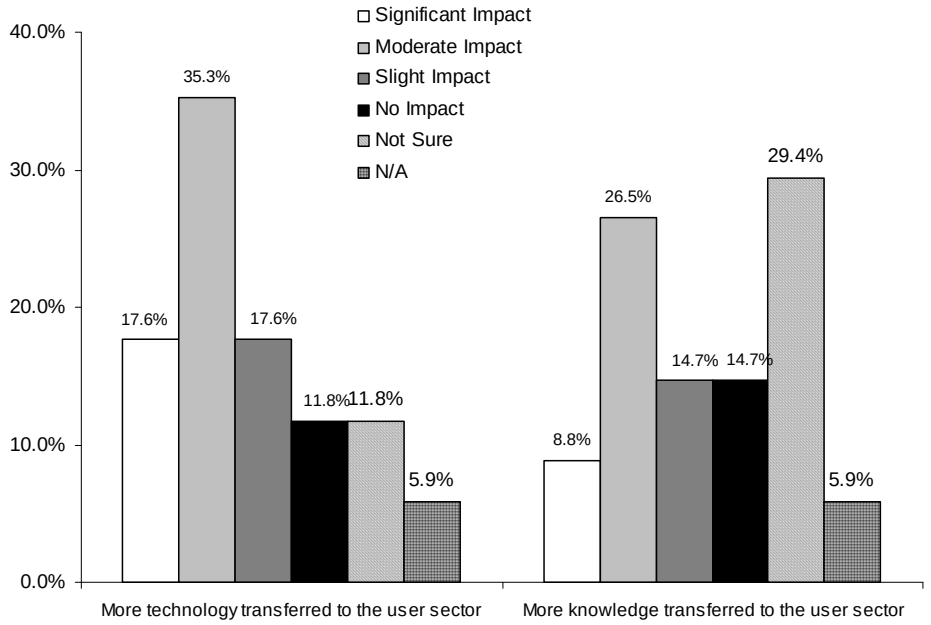
extent their institutions transfer more knowledge to the user sector, and researchers were asked to what extent they are more involved in knowledge transfer now compared with five years ago. As illustrated in Exhibit 3.5, the majority responded that knowledge transfer has increased, however, researchers report that it has increased less than TTO/ILO Directors and VPs of Research believe. It should be noted that the knowledge transfer component of the IPM program is a relatively new area and, aside from one funded project, is not directly funded by the program.

Exhibit 3.5 – Perceived Increases in Knowledge Transfer in the Last 5 Years



Findings from the evaluation survey and mini-case studies suggest that some of the increased technology and knowledge transfer activity occurring at Canadian institutions is attributable to IPM. As the survey respondents most familiar with IPM, TTO/ILO Directors were asked to what extent IPM is responsible for the observed increases in technology and knowledge transfer. Their responses, presented in Exhibit 3.6 below, demonstrate that about 20% feel that IPM has had a significant impact and just over 40% feel that IPM has had a moderate impact in transferring more technology to the user sector. They report that the IPM impact on knowledge transfer is somewhat less strong.

Exhibit 3.6 – Perceived Impact of IPM on Technology and Knowledge Transfer



Source: Directors Survey (n=34)

Due to the fact that IPM funding represents only one of many funding sources for TTO/ILOs, Directors cannot quantify the precise impact of IPM. The mini-case studies however, provided some insight into how IPM assists institutions to transfer knowledge and technology to the user sector. The primary influence of IPM would appear to be the hiring of commercialization officers to conduct activities that would otherwise not be conducted, such as receiving invention disclosures, evaluating their patentability and commercial potential, and conducting industry and researcher outreach activities.

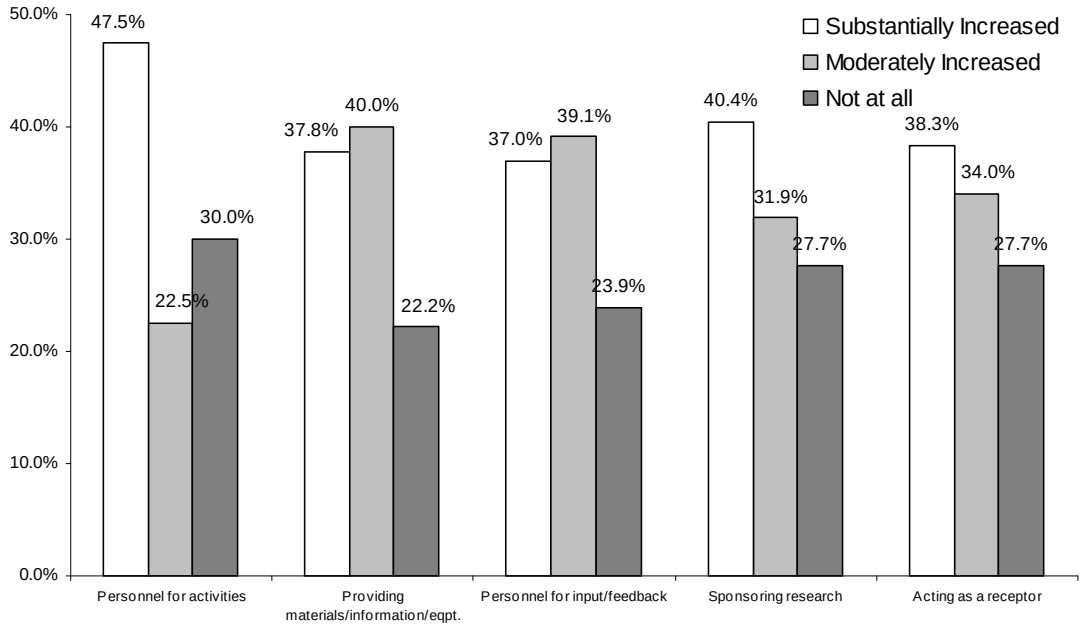
A second influence of IPM has been on the collaboration and networking that occurs between institutions. Networking provides researchers with access to other researchers that can assist them in technology development. Networking provides researchers with access to specialized expertise, in licensing for example, which would not typically be available to researchers at most institutions, save the largest of the institutions included in the mini-case studies. Networking also appears to be a useful means of introducing receptors to researchers who may conduct research in a mutual area of interest.

Issue 3b: Increased participation from IP users (e.g., industry and public)

Finding 3b: The evaluation's survey of IP users revealed that they are on average collaborating with institutions on research and acting as a receptor for research results more now than five years ago, and expect to increase these activities in the future. About 19% of TTO Directors believe that IPM is significantly responsible for increasing their collaboration with IP users, and another 31% believe the impact has been moderate. A major influence on IP user participation rates appears to have been the use of IPM funding to hire and train staff to conduct industry outreach activities and seminars, and establish officers in institutions, where none existed before, in order to reach more potential IP users. Another major program influence has been IPM funded internship training programs. Evaluation evidence suggests that the graduates of these programs are working in venture capital firms, technology companies, or engaged in entrepreneurial activities, and the contacts they have made with their host TTOs/ILOs and fellow interns are helping to facilitate technology transfer activities.

Overall, IP receptors revealed in the survey that they are participating more in technology and knowledge transfer than five years ago, and they expect their involvement to increase in the future. Exhibit 3.7 illustrates that the majority of IP receptors surveyed reported an increase in the following interactions with Canadian universities, colleges or research hospitals in the last five years: sponsoring research; providing materials/equipment/information required to carry out research; providing personnel for ongoing input and feedback on the research being performed; providing personnel to carry out activities essential to the research being performed; and acting as a receptor for the results of the research.

Exhibit 3.7 –IP User Interaction with Institutions Compared with 5 Years Ago



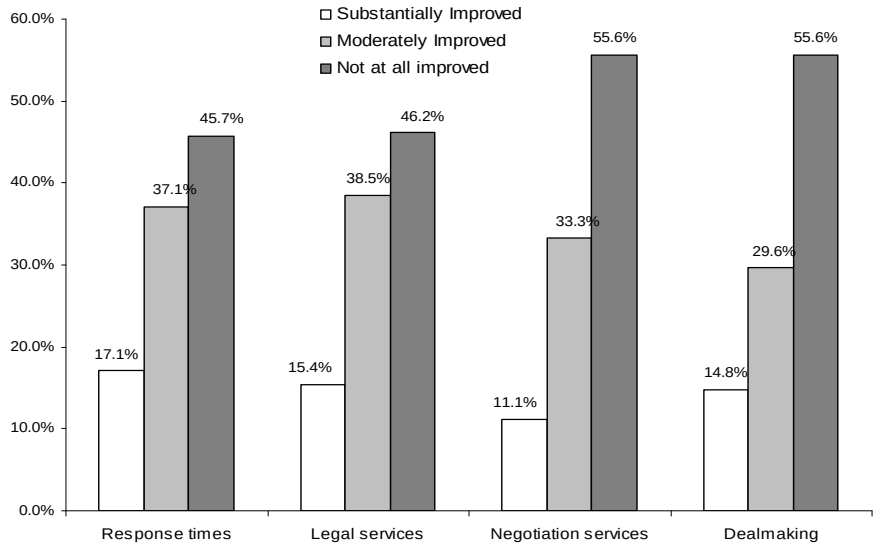
Source: IP Receptor Survey (n=47)

The mini-case studies provide some evidence of how the IPM program is assisting institutions to better collaborate with and transfer knowledge and technology to users. For example, anecdotal evidence from mini-case studies revealed that IPM funding permitted institutions to hire personnel to conduct more seminars targeted at informing potential IP users (typically from industry) of the type of research being conducted at their institutions. IPM funding also permitted the establishment of commercialization officers at institutions where previously none existed (e.g., hospitals) in order to reach more potential users. IPM funding has also helped to partner colleges, which have strong ties to industry, with more experienced and larger university TTO/ILOs.

The mini-case study evidence of IPM's positive impact on participation rates of IP users is supported by survey responses from TTO/ILO Directors. Nineteen percent of Directors indicate that the impact of IPM on the extent of their collaboration with potential users of research results has been significant; 30.8% moderate; 34.6% slight; and only 15.4% indicated no impact.

Response times and overall service levels offered by TTOs/ILOs can influence the willingness of IP receptors to use their services. The mini-case studies revealed that the hiring of additional commercialization officers with IPM funding improved response times and overall service levels offered to industry receptors. Recently improved service levels were identified by a receptor in the biomedical field as a key factor in her decision to continue a partnership with an Ontario research hospital. Exhibit 3.8 presents the survey responses of IP receptors, which reveal that there have been some modest improvements in service levels at TTO/ILOs in the past five years; however, significant room for improvement remains.

Exhibit 3.8 - Improvements in TTO/ILO Service Levels in Last 5 Years (as perceived by IP Receptors)



Source: IP receptor survey (n=60)

As discussed above, the mini-case studies revealed that many internship training program graduates are currently working with technology companies, venture capital firms, or engaged in entrepreneurial activity. This evidence suggests that these training programs are resulting in an unintended positive impact for the IPM program on amount of knowledge and technology transferred to the user sector. For example, commercialization deals are occurring that otherwise would not, because of the personal relationships

developed and maintained between university commercialization officers, IP receptors, and venture capitalists that participated in the internship programs.

Issue 3c: More researchers involved in technology and knowledge transfer?

Finding 3c: Fifty-six percent of researchers reported that they were significantly more involved, and 17.5% indicated they were moderately more involved in technology transfer than five years ago. These figures are somewhat lower for knowledge transfer.

The evaluation found that IPM has had two key impacts on researcher activity in technology and knowledge transfer. First, IPM funding has enabled TTOs/ILOs to hire additional personnel to conduct outreach activities to researchers; these activities have made researchers aware of the office, its services, and their role in protecting IP and encouraging commercialisation. Second, the use of IPM funding to hire additional staff has also improved service levels (i.e., response times), which encourages researchers to use the TTO/ILO.

Researchers reported via the evaluation survey that they are more involved in technology transfer now compared with five years ago. Fifty-six percent of researchers stated that they were significantly more involved in technology transfer, and 17.5% indicated they were moderately more involved compared with five years ago. The involvement of 19% of researchers was unchanged. According to a survey of NSERC researchers conducted in 2007, 500 out of 2,590 researchers (19.3%) had filed for a patent and 781 researchers (30.2%) had used their university's technology transfer office in the last five years.

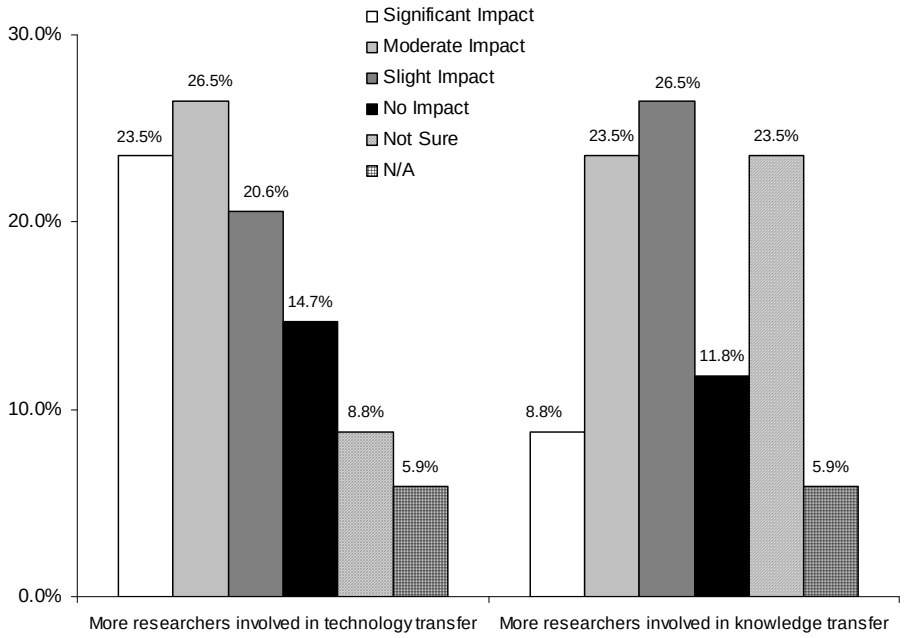
Interviews conducted with researchers at institutions that participated in the mini-case studies revealed that key reasons for increased researcher activity have been faculty outreach activities conducted by the TTO/ILO and improved service levels offered to researchers.

Increases in researcher activity in knowledge transfer were less significant in the last five years according to researchers who responded. Only 24%

indicated they were significantly more involved in knowledge transfer, and 22.1% indicated that they were moderately more involved. Twenty-five percent were unchanged.

The survey of TTO/ILO Directors revealed that the majority believe that IPM has had an impact on increased participation by researchers; however, as illustrated in Exhibit 3.9, the program appears to have had a larger impact on the number of researchers engaging in technology transfer than knowledge transfer.

Exhibit 3.9 – Impact of IPM on Researcher Activity in Technology and Knowledge Transfer

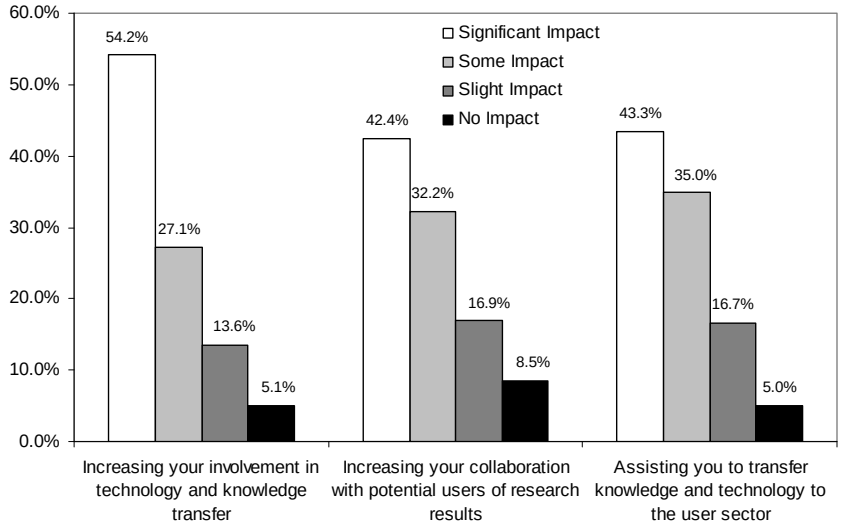


Source: TTO/ILO Director survey (n=34)

The mini-case studies also revealed that researchers are more likely to disclose inventions to their institutional office if they know that funding is available to advance their technology to where industry might take an interest. This was the case at 3 mini-case study institutions that used IPM funding for demonstration projects. This finding was corroborated by survey results from 59 researchers who conducted demonstration or pilot projects with IPM funding. As illustrated in Exhibit 3.10 below, according to researchers, the receipt of funding to further the development of their inventions has a very

significant and positive impact on their ability to collaborate with potential users of results, and the transfer of those results.

Exhibit 3.10 – Impact of IPM Funded Demonstration/Pilot Projects on Researchers



Source: Researcher survey (n=59)

In addition, mini-case study findings revealed that the incentive structure within universities is beginning to encourage researchers to become more involved (e.g., the royalty is often split 50/50 between university and the researcher) and 3 VPs of Research who participated in mini-case study interviews, reported that they are starting to place greater emphasis on hiring new professors with a focus on technology and knowledge transfer.

Issue 3d: Strengthened ability of institutions to mobilize their IP?

Finding 3d: IPM has strengthened the ability of institutions to mobilize their IP in two key ways. First, by increasing the number of licensing FTEs in TTO/ILOs the IPM funding has enhanced the capacity of the offices to mobilize their IP. IPM support of internship training programs and salary support for professionals has allowed offices to hire qualified professionals and increase staff size to accelerate technology and knowledge transfer activities. The

impact of additional TTO/ILO staff has translated into faster response times, and improved negotiation, marketing, deal making, and legal services. Survey findings reveal that licensing revenues and patents increased at TTO/ILOs that increased their FTEs in the last five years, while the opposite was true for offices that did not increase their FTEs.

Second, for some small universities and hospitals, IPM funding has both created and enhanced the capacity of the TTO/ILO to mobilize their IP. From some institutions, the funding has meant the difference between having a dedicated full-time technology transfer resource and not having one at all. The program has also helped small institutions to increase their ability to mobilize IP by networking with larger and more established offices. For these institutions, the IPM program has dramatically increased capacity.

Based on mini-case studies and key informant interviews, IPM has assisted institutions in mobilizing their IP in several ways. First, IPM has allowed TTO/ILOs to increase staff size. Sixty-seven percent of IPM grants awarded to mini-case study participants supported the hiring or retention of personnel. Currently, IPM supports 24.8 licensing FTEs or 21.6% of all licensing FTEs in the offices of mini-case study participants. By increasing staffing levels, institutions have been able to reach out to researchers to solicit invention disclosures, and to reach out to industry to involve them in product development. Furthermore, additional staff has permitted existing staff to catch up on the backload of disclosures that had not yet been evaluated. The evaluation survey also supported the findings of the mini-case studies. Licensing FTEs, as reported by TTO/ILO Directors, have increased by 157.8% in the last five years, as illustrated in Exhibit 3.11.

Exhibit 3.11 – FTE Levels at Institutions

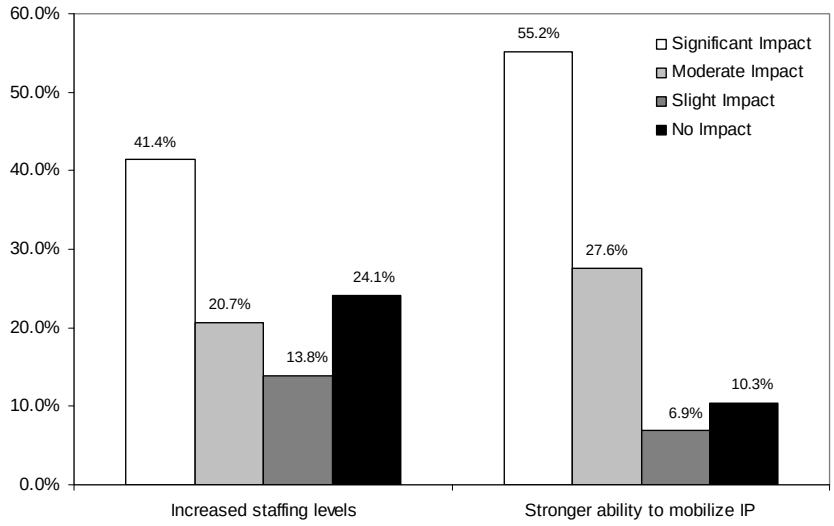
	Five years ago	Today	% Change
Licensing FTEs	32.5	83.8	157.8%
Other FTEs	31.7	103.7	227.1%
TOTAL	64.2	187.5	192.1%

Source: TTO/ILO Directors survey (n=22)

As illustrated in Exhibit 3.12, 55% of Directors indicated in the evaluation survey that IPM had a significant impact on their ability to mobilize IP and

approximately 41% of Directors indicated through the survey that IPM had a significant impact on staffing levels in their offices. A closer examination of the survey data revealed that TTOs that added more capacity (as measured by FTEs) have annual licensing revenue today that is, on average, $66K higher than five years ago. Furthermore, they currently hold, on average, 7.7 more active patents per TTO/ILO than five years ago. In contrast, licensing revenues fell by $41K and the number of active patents did not increase from five years at TTOs that did not increase their FTEs. These findings are supported by evidence from the mini-case studies, where TTO/ILO Directors stressed a strong relationship between the use of the IPM program to hire officers, the number of commercialization officers in the office, and the capacity of the TTO/ILO to conduct successful technology transfer.

Exhibit 3.12 – Impact of IPM on Staffing Levels and Ability to Mobilize IP



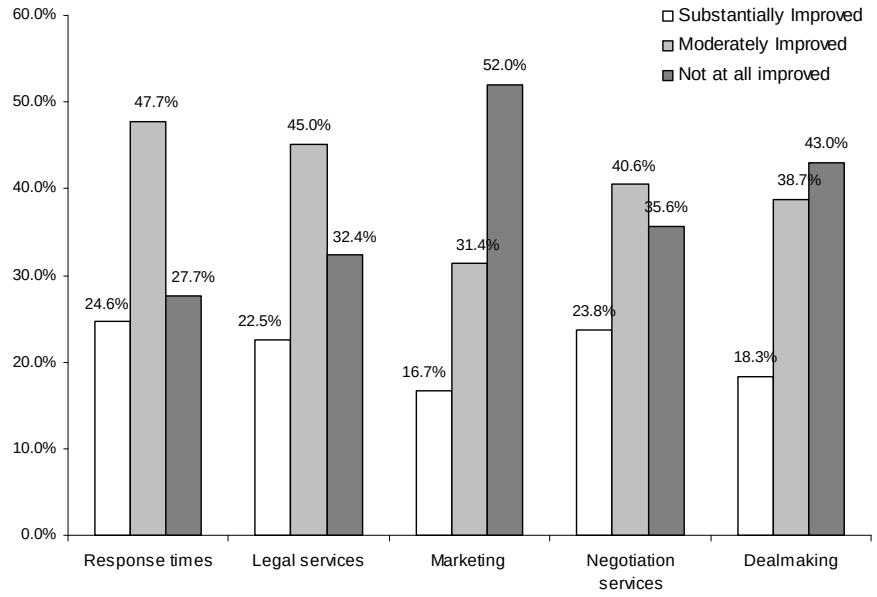
TTO/ILO Directors survey (n=29)

The mini-case studies revealed that prior to IPM funding, the service levels that some TTOs/ILOs could offer to researchers and receptors were admittedly "limited". For example, according to the researcher and IP receptor interviewed for the one mini-case study, staff in the technology transfer offices of some member hospitals was "run ragged" with existing responsibilities and the situation was "unsustainable". In other cases, IPM funding was even more critical. For some mini-case study participants, IPM funding was the difference between having a dedicated full-time resource for technology

transfer and not having one at all. Specifically, this was the case for some institutions that are members of an intellectual property network, certain research hospitals, and some small universities.

The mini-case studies revealed that researcher and IP receptor satisfaction with their TTO/ILO is important because they will be reluctant to use the services of an office if they do not receive good service. Through the survey, researchers were asked to describe their level of satisfaction with the services provided by their TTO/ILO compared with five years ago (see Exhibit 3.13). Their responses concerning the services provided by TTO/ILOs were similar to the responses of IP receptors. While there have been some strides made in response times, legal services, and negotiation services, there is still considerable room for improvement, particularly in marketing and dealmaking.

Exhibit 3.13 - Improvements in TTO/ILO Service Levels in Last 5 Years



Source: Researcher survey (n=60)

IPM has also helped institutions to develop policies and tools for officers, which enhanced office capacity to mobilize IP. These policies and tools are often shared with smaller institutions that participate in networks so that they do not have to "reinvent the wheel". This sharing and networking can quickly increase the capacity of small offices to mobilize IP. The following mini-case

study findings provide examples of the impact IPM funding have had on the capacity of institutions to mobilize their IP:

- One Quebec institution provided its network partners with full access to its agreement models (14 in all, covering license agreements, research agreements, confidentiality agreements, joint IP management agreements, etc.) in both official languages. The institution also shared accounts of its experience with its approach to technology evaluation and techniques for identifying available markets;
- IPM funding allowed an institution to purchase the INTEUM intellectual property management software and develop IP assessment tools and databases in order to produce enhanced financial assessments of patentable technologies. An Excel based tool for technology evaluation was also developed;
- An institution from Atlantic Canada used IPM funding to create a database system called MyIP, which tracks its patent portfolio and is used to collect accurate statistics on its operations;
- An Ontario university used IPM funding to support a technology and patent prosecution database with the ability to electronically link scanned documents. The database created a more professional document and activity/milestone management system and the addition of this system allowed the position of the technology transfer assistant to become a higher value position; and
- A network of Ontario universities used IPM funding to create a commercialization handbook titled *An Introductory Guide for Researchers*.

Issue 3e: An increase in trained technology and knowledge transfer professionals? Are these trainees new or pre-existing staff, or a mix thereof? To what extent has this training been effective?

Finding 3e: A significant portion of IPM funding (about 17% in the 2005 round) has been directed toward training professionals. The evaluation found that recipients of training are a mix of new and pre-existing staff. Findings from the mini-case studies of two IPM funded internship training programs indicate that the programs have produced a total of 74 graduates to date. The

number of graduates is higher when the remaining two internship programs are factored in. Graduates of these programs are working in TTO/ILOs, venture capital firms, and technology companies. Short-term training courses also appear to be effective in increasing the skills of existing staff.

A review of the IPM grant database revealed that the program funded nearly $3M of training initiatives carried out by Canadian institutions in 2005. IPM has supported two main types of training over the years: internship training programs (typically 18 months in duration) and short-term courses offered by AUTM and ACCT. Since 1995, approximately 28 of 63 grants awarded to mini-case study participants (44.4%) have supported training activities.

The mini-case studies of two internship programs revealed that 74 professionals have graduated since 2004, and about 53% have accepted positions in TTOs/ILOs. Although key informants could not speak to specific training impacts, they offered some general impressions. Interviewees indicated that internship training, such as the training provided by networks like WestLink, provide "on-the–job" and "hands on" training opportunities that are very different from a university education, which tends to be more abstract. One interviewee described the training as "sort of like flight training rather than just reading a book about flying." Another interviewee noted, "[v]ery few people know how to bridge the public and private sector. If you have someone who has been trained in this environment, it's really a big plus." The views of key informants were supported by surveys completed by graduates of these programs. Nearly 80% of graduates responded that the internship program had significantly increased their technology transfer skills (see Exhibit 3.14).

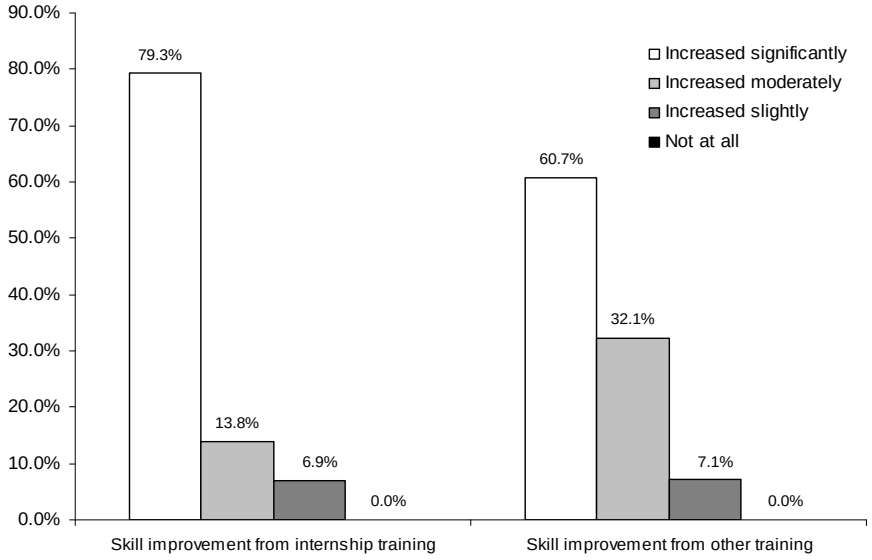
The mini-case study of WestLink revealed that the IPM support for a dedicated Internship Program Manager has resulted in improved course content, and a wider spectrum of hosting opportunities. Presently, there are more willing host organizations than available interns. Several interns have found employment with their host organization, even at venture capital firms where junior hires are not normally given consideration. The graduate interns are viewed as "valuable commodities" that can contribute right away, particularly in small start-up companies. At TTOs, the addition of high quality interns and graduates has freed officers up to devote more time to evaluate new technology

disclosures. The Atlantic region's internship program (Springboard) was funded by IPM and based on the WestLink model.

In addition to internship training, technology and knowledge transfer professionals participate in a number of other training activities. Recipients of training reported having attended conferences (73%); courses (70%); and received mentoring (38%). Approximately 53% of survey respondents reported that these other types of training had increased their skills significantly. IPM grants have partially funded several training courses, often provided by ACCT or AUTM, that are targeted at more experienced staff than the internship programs, and focus on improving specific skills such as evaluating technologies, licensing, and negotiation skills. In addition, just under half (44.4%) of surveyed training recipients indicated that they have received specific training in knowledge transfer. Of these, one-half reported that their knowledge transfer skills had improved significantly as a result of the training. Consistent with the responses of training recipients, one-half of TTO/ILO Directors surveyed indicated that the IPM program had a significant impact on the observed skill level increase, and 32.1% indicated that IPM had a moderate impact on skill level.

Although the training has been effective, evidence indicates that there remains a need for more training of new and pre-existing TTO/ILO staff. About 20% of researchers and 13.3% of IP receptors still consider the limited expertise of TTO/ILO staff to be a very significant barrier to successful technology and knowledge transfer. Overall, 43.9% of IP receptors and researchers feel that the problem of limited TTO/ILO expertise is either very significant or moderately significant. The top five most significant training needs of staff, according to Directors, are market research, technology assessment, understanding start up companies, deal making, and evaluating invention disclosures. Recipients of training echoed the need for more training in these areas, but also pointed out training in searching and filing patents, and handling research contracts were key training needs as well.

Exhibit 3.14 – Skill Improvement from Training



Source: Recipients of training survey (n=29)

Issue 3f: What impact do group awards have on the ability of networks of institutions to carry out technology/knowledge transfer and commercialization? To what extent do networked institutions cooperate amongst themselves?

Finding 3f: Group awards have increased the ability of small institutions to carry out technology and knowledge transfer, by providing them with access to the expertise and administrative support of larger institutions. Some of the forms of networking between TTOs/ILOs include the sharing of best practices, providing access to additional people with expertise, the standardization of IP procedures and disclosure forms, and the establishment of non-disclosure and confidentiality agreements which have encouraged cooperation across institutions. One drawback of requiring institutions to submit group applications is that some remotely located institutions who cannot easily partner with other institutions may be unable to apply for IPM funding.

Key informants revealed that the IPM program announcement to eliminate individual grants in favour of a group funding approach was met with

apprehension and reluctance by institutions. According to most key informants and mini-case study participants, the decision has proved to be sound however, and there is now positive feedback from institutions. In the words of one key informant: "[the program] forced a culture change – for the better."

Key informant interviews, mini-case studies and surveys provided evidence on how group awards have assisted TTOs/ILOs to become more effective than they would have been if they had operated in isolation. Examples of how group awards have assisted offices include standardized approaches such as common disclosure forms and the establishment of non-disclosure agreements/confidentiality agreements that have been important to ensuring the protection of IP and encouraging cooperation across institutions. A few TTO Directors interviewed during the mini-case studies stated the networks are an excellent source of referrals that have led to connections between researchers and industry that would otherwise not have happened.

The change to group grants has forced larger universities to interact with smaller institutions and help them build capacity. In fact, the impact and benefits of networking appear to be particularly significant for small institutions that can take advantage of the technology transfer infrastructure developed by larger institutions. For example, a mini-case study of a small Atlantic university found that participating in a network is critical for the TTO's ability to carry out technology and knowledge transfer because as a small office it must focus its resources in a single area of specialization (biosciences). Occasionally, the TTO/ILO sees practical IP outside the area of the biosciences (e.g., three-dimensional music, a product developed by its psychology department); however, it lacks the expertise to evaluate such technology and the resources to develop it. In cases such as this, the university uses its membership in the Springboard network to access resources (e.g., specialists and specialized knowledge) not available in-house to develop commercially viable IP.

Findings from the mini-case studies indicate that IPM funding has supported the development of a high degree of cooperation and expertise has been shared between institutions at the levels of commercialization officer, TTO Director, and researcher; this includes the sharing of training and educational materials. For example, members of a hospital network in Ontario now meet once per

month, something they did not do before the receipt of IPM funding to support their networking activities. An IPM grant was the catalyst for the creation of the Southern Alberta Intellectual Property Network (SAIPN), which facilitates the sharing of knowledge and resources for technology transfer between two Prairie universities and four surrounding colleges. Similarly, IPM funding enabled the establishment of the C4 network in south-western Ontario which aims to enhance the capacity of participating institutions through the hiring of technology transfer officers, exchanging of knowledge and ideas, and promoting of products and market development. Here, mini-case study findings of participating institutions revealed that if IPM funding were discontinued the network would lose people as well as the support to necessary to navigate the legal issues surrounding IP. For one large university that participates in C4, the impact of losing IPM funding would result in significantly reduced operations because it has relied on the IPM to support most of its salary costs to hire C4 specialized staff. However, the current funding situation is fragile as C4 has built counterpart funding from the province.

Networking also helped link academics at different universities that were working on similar issues but were unaware of each others' work. According to one interviewee, "when you have groups of institutions coming together around a common research discipline, that can be very strong when using a strong TTO at one of the participating universities. This can be very attractive to private firms."

Given that colleges only became eligible for IPM funding in 2005, the impacts of IPM funding on colleges are nascent and will become clearer in the coming years. Findings from the mini-case study of a large Prairie university and its network of a small university and four surrounding colleges indicate that the development of the SAIPN has had the following impacts on the participating colleges to date:

- The well-developed technology evaluation and commercialization resources of the university involved are now available to other institutions in the network with very limited tech transfer capabilities;

- New opportunities for collaboration between researchers – including university researchers with experience in the lab and college researchers with experience testing new technologies – are being identified;
- New market opportunities are being discovered for some of the technologies being developed at the participating institutions;
- Those involved in technology transfer are learning from the processes and practices put in place by colleagues at other institutions; and,
- With their enhanced ability to protect IP, the colleges are finding that they are in better position to obtain provincial funding for research and technology development.

The surveys supported the findings of mini-case studies and key informants. TTO/ILO Directors whose institutions were part of a group IPM grant indicated that the sharing of best practices (55.6% of responses), improved coordination across institutions (27.8%), and having access to additional people with special expertise (16.7%), were the most significant benefits of group grants.

Eighty-percent of TTO/ILO Directors who responded to the survey indicated there were some drawbacks to group grants, however. Drawbacks include onerous reporting requirements when funding comes from different sources and each funding source has different reporting criteria, the amount of time required to prepare and manage the group application can be significant, and difficulties can be encountered when institutions have differing IP policies. Key informant interviews and mini-case studies revealed that creative ideas can be left out when group applications must be submitted, since not all members of the group may agree with the ideas. Furthermore, partnerships should be chosen carefully, to avoid "awkward marriages of convenience", where for example, the technology transfer offices of two closely located institutions apply for a group grant, but later determine that they do not work well together. Administrative time required by TTO Directors to manage group grants can also be a significant drawback.

Based on discussions with key informants, networking to date appears to be limited to geographic partnering. Generally, partnering has occurred between institutions located in the same province or region of Canada. Key informants

believe there is a need to encourage institutional partnering based on research strengths regardless of location.

It should be noted that remotely located universities that focus on local interests cannot easily partner with other institutions. A case could be made that IPM requirements should be more flexible to take account of situations where networking does not work well.

Issue 4: To what extent do impacts differ by size of institution, region of the country, and size of the TTO/ILO?

Finding 4: IPM impacts differ more by institution size and sophistication than by location. For small institutions, the program's impacts have been significant. In some cases, IPM has been responsible for establishing the TTO/ILO or supporting a full-time dedicated resource. Due to IPM's rather large share of the operating budgets of small offices, the loss of IPM funding may jeopardize the existence of the offices altogether. In larger and more sophisticated TTOs/ILOs IPM funding is a smaller share of operating revenues. Nevertheless, the program has helped to increase office capacity by hiring additional officers and, for very sophisticated operations, support new initiatives. From a regional perspective, the most significant IPM impact has been the support of regional internship training programs, which have increased the availability of highly qualified professionals and encouraged closer ties between academia and industry.

Issue 4a and 4c: Do Impacts Vary By Size of institution? By the size of the TTO/ILO? By Level of Sophistication of the TTO/institution?

Finding 4a: IPM program impacts do vary by institution size and sophistication of TTO/ILO. The sophistication of TTOs and their corresponding institutions appears to be a factor of the age of the office and the level of research expenditures at the institution. With a few exceptions, relatively large universities generally have relatively large TTO/ILOs (as measured by FTEs), and small universities generally have small TTO/ILOs.

Large research hospitals tend to have small and relatively new TTO/ILOs, or merely one dedicated resource.

At small institutions, combined data from the survey and case studies indicate that IPM funding accounts for a significant share of the TTO/ILO operating budget (about 25%) and is often used to support the Director or a full-time dedicated resource. The loss of IPM funding would jeopardize the existence of some offices.

At medium sized institutions, IPM funding accounts for, on average, about 16% of the office's operating budget. The funding often supports additional commercialization officers rather than the Director, and generally increases the offices' ability to respond to the increasing number of researcher invention disclosures, and conduct outreach activities. The activities conducted by additional staff, have over time raised the commercialization figures of medium sized institutions.

At large institutions, IPM accounts for, on average, only 3% of office funding. Typically, the funding supports the salaries of additional commercialization officers or personnel with special expertise, although sometimes it is used to launch new initiatives.

The evaluation found, based on mini-case studies and survey responses that IPM funding accounts for a significant share (24.7%) of the budgets of small universities. In some cases, IPM accounted for 30% or more of their office budget. The impact of IPM to these institutions has been significant. Funding has supported the salary of the TTO Director in some cases, and its loss would jeopardize the existence of some offices. Currently, IPM supports 1.5FTEs in the TTOs/ILOs of the three small universities that participated in the mini-case studies. The survey revealed that for 28.6% of Directors at small universities believe the IPM program has had a significant impact on increased staffing levels in their office; 85.7% feel the program has had a significant impact on their ability to link and network with other technology transfer offices; and 42.9% feel the program has significantly strengthened their institution's overall ability to mobilize intellectual property. IPM's major impacts on small universities would appear to be the establishment or support of a TTO Director

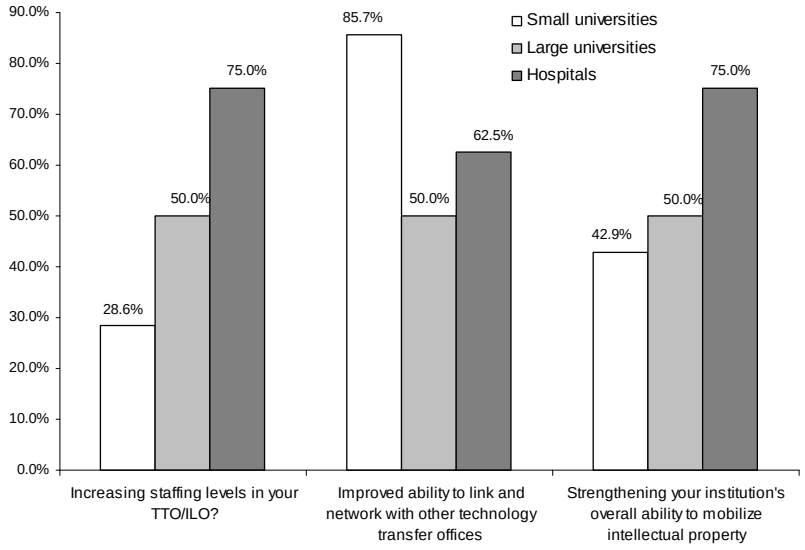
or dedicated resource, improved networking with other offices, and in some cases, the funding is necessary to continue operations.

IPM funding at medium sized universities accounted for, on average, 15.6% of their TTO/ILO budgets. One of the significant impacts of IPM for medium sized universities has been the hiring of additional commercialization officers, which has increased the volume of disclosures received, outreach activities conducted, and the general rate of commercialization achieved. At the four medium sized institutions that participated in the mini-case studies, IPM funding currently supports 4.1 of 14.3 licensing FTEs (29%). Half of the TTO/ILO Directors at medium sized universities that responded to the survey felt the program has had a significant impact on staffing levels, on their ability to link and network with other technology transfer offices, and has strengthened their institution's overall ability to mobilize intellectual property.

At large universities, IPM accounts for on average, 3.3% of the TTO/ILO budget. IPM funding is used to support the salaries of additional commercialization officers. For example, IPM currently supports 21% of licensing FTEs at the eight large universities that participated in the mini-case studies. IPM funding has helped these offices to respond to increasing research expenditures and invention disclosures, hire personnel with special expertise, have access to a stream of high quality hires via internship training programs, and conduct initiatives such as Entrepreneur-in-Residence. For example, one university's IPM funded Entrepreneur-in-Residence coordinates the following entrepreneurial-related activities, including some activities within the university's business school: established a Venture Hub Network on campus; developed education programs (such as the "Know-How" entrepreneurship seminar series and "Investor-Ready 101"); created an entrepreneurship web portal; and mentored researchers, along with the technology transfer staff and the managers of new spin-off companies.

Three quarters of TTO/ILO Directors surveyed at large universities stated that the program has significantly impacted staffing levels and their ability to mobilize IP. Approximately 62% responded that the program's impact on networking and linkages has been significant.

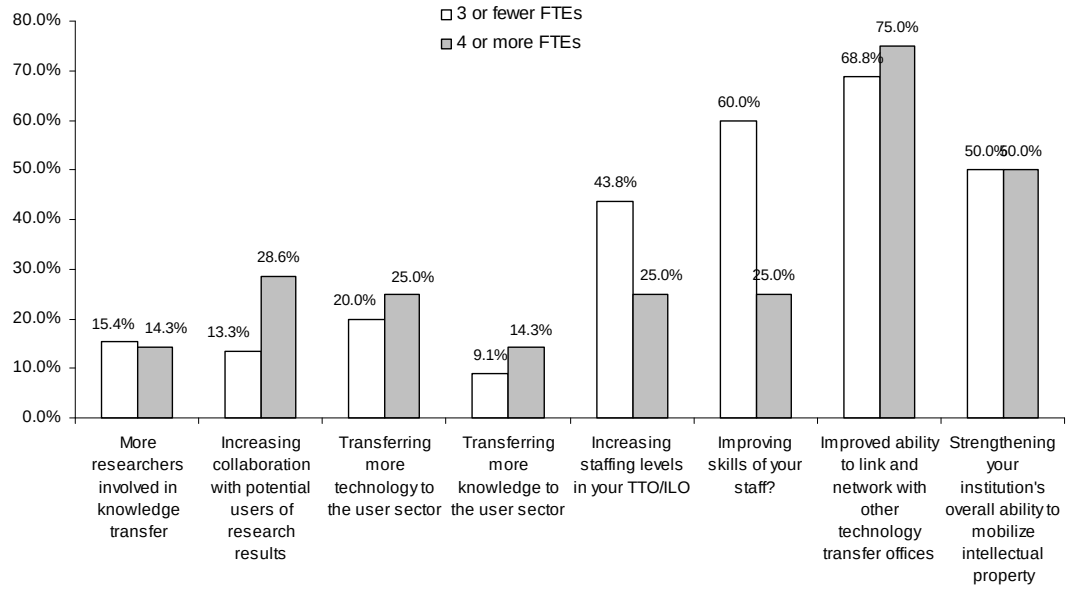
Exhibit 3.15 – Significance of Program Impacts by Size of Institution



Source: TTO/ILO Directors survey (n=29)

Although there were no specific survey questions that asked TTO/ILO Directors to identify the level of sophistication of their office or institution, the number of current licensing FTE at TTOs/ILOs is probably the most suitable proxy measure of sophistication. IPM impacts as indicated by Directors responding to the survey were examined in relation to the number of licensing FTEs in their offices. Respondents were separated into two groups: those with 3 or fewer licensing FTEs and those with 4 or more. The least "sophisticated" office had 0.6 licensing FTEs and the most "sophisticated" had 35 FTEs. The response data presented in Exhibit 3.16 indicates that the IPM program's impact on both "sophisticated" and "less sophisticated" offices has been very similar in the following areas: the number of researchers involved in knowledge transfer, the transferring of technology and knowledge to the user sector, networking, and the strengthening of overall ability to mobilize IP. There are some differences; however, between the two respondent groups. For less sophisticated TTOs, the program appears to have had a greater positive impact on increasing staffing levels, and improving staff skills, while for more sophisticated offices the program appears to have had more of an impact on increasing collaboration with potential users of research results.

Exhibit 3.16 – IPM Impacts by Sophistication of TTO/ILO



These survey findings were supported by the mini-case studies, which suggested that IPM's largest impact on less sophisticated offices has been in increasing human resource levels. In general, the mini-case studies suggest that the sophistication of the TTO is very much a factor of its age and the amount of research activity (as measured by expenditures) at the institution.

In the course of conducting the mini-case studies, TTO/ILO Directors and VPs of Research were asked to discuss the impacts to their institutions were IPM funding discontinued in the future. Their responses revealed that small institutions would experience greater impacts than large institutions in the event of discontinued funding. Large institutions would be forced to lay off commercialization officers supported by IPM, which would slow the pace of commercialization, and certain initiatives supported by IPM such as Entrepreneur-in-Residence programs and some networks might be discontinued. Medium sized institutions typically have just a handful of commercialization officers; hence, the loss of IPM funding would force them to eliminate officers supported by IPM. This loss would have a greater impact on the overall capacity of the office to conduct commercialization activities than that of larger institutions. The ability of medium sized institutions to train officers and specialize in certain areas (e.g., biomedical, information

technology) would be reduced. Small universities would feel the impact of the loss of IPM funding the most. Some TTO/ILOs would be forced to close; others would see their capacity cut in half (i.e., a reduction from two commercialization officers to only one).

Based on discussions with stakeholders, it would appear that the loss of IPM funding for internship training programs would impact institutions of all sizes fairly equally. The programs are essential for ensuring a source of highly qualified commercialization officers is available to TTO/ILOs facing attrition and future retirement of key staff.

Issue 4b: Do Impacts Vary by Region of the Country?

Finding 4b: IPM program impacts vary more by size of institution than by region of the country. There are some differences worth noting. In Atlantic Canada, where many of the institutions are relatively small, IPM has been important for developing TTO/ILOs, providing salary support for TTO/ILO Directors, and supporting the regional network, Springboard. In Quebec, IPM has contributed to the development of downstream commercialization entities such as SOVAR, which provide institutions with specialized expertise in evaluating the market potential of technologies and managing university spin-off firms. A significant impact in the Pacific and Prairie regions has been the support of the WestLink internship training program.

The mini-case studies and surveys suggested that impacts vary more by size of institution or its remoteness, than by the region in which it's located. Nevertheless, the following impacts were noted according to geographic location.

Atlantic Canada

Major IPM impacts in Atlantic Canada have been the acceleration of technology transfer activities through the salary support of TTO/ILO Directors at small institutions, and the support of additional commercialization officers at most institutions. IPM funding has also been instrumental in the establishment of the Springboard network, which has provided a source of high quality professionals for TTOs/ILOs, and encouraged networking between institutions in the region.

Quebec

Quebec has pursued a different commercialization strategy than the other Canadian regions by creating four commercialization enterprises to handle spin-offs, market evaluation, and commercialization activities for Quebec universities and hospitals. A 1995 IPM grant to a Quebec university played a role in the development of one commercialization entity, Société de Valorisation des Applications de la Recherche (SOVAR). IPM grants have helped to increase the capacity of institutions through salary support for additional officers, which have resulted in corresponding increases in invention disclosures. For instance, IPM salary support enabled one institution to hire an expert who developed a significant environmental engineering research sector, to hire a commercialization officer who has boosted invention disclosures from 2-3 annually to more than 30 recently, and to conduct pilot projects, one of which has subsequently attracted investment from the provincial government and Sanyo.

In addition, IPM grants have also supported the InterVal internship program, which has produced 34 graduates employed at other offices, venture capital firms, and technology firms.

Ontario

There is a wide variation of institutions across Ontario with a mix of small, medium, and large universities. Overall, training and capacity building have been the largest impacts. For example, IPM currently supports 40% of licensing FTEs at the seven universities, and 21% of the FTEs at the hospital networks that participated in the mini-case studies.

Pacific/Prairies

The Pacific and Prairie region have a wide range of institutions by size and, as such, the impacts of the IPM program vary from large to small institutions. A significant impact in these regions, partially attributable to IPM funding has been that of WestLink. In particular, the network internship training program has graduated 39 professionals to date, who have found employment at institutional technology transfer offices, venture capital firms, and technology companies. By keeping in touch through WestLink sponsored events, closer relationships between academia and industry have been forged, which have

already led to commercialization deals occurring that would have not occurred in the absence of WestLink.

Issue 5: What has been the impact of CIHR and SSHRC joining the IPM program in 2001?

Finding 5: The inclusion of CIHR has greatly increased overall IPM funding levels and enabled hospitals to dedicate a full time resource to technology and knowledge transfer and/or participate in a network that gives them access to the tools, know how and expertise of large university TTOs/ILOs. The impact of SSHRC is less clear; SSHRC funding for IPM has been relatively small. The TTOs/ILOs perceive they are well suited to handle knowledge mobilization efforts, a primary SSHRC objective, but there remains confusion over the definition of knowledge transfer across TTOs/ILOs.[10] There would appear to be some anecdotal evidence of increased knowledge transfer activities in recent years due to IPM, however it lacks the consistent measurement approach of technology transfer.

Issue 5a: How has the inclusion of research hospitals impacted the overall results?

Finding 5a: The inclusion of research hospitals has had several impacts. First, the inclusion of CIHR in the IPM program has greatly increased overall funding levels and enabled CIHR to serve an emerging community of TTOs/ILOs at hospitals that were previously ineligible for NSERC funding. Second, several IPM grants have enabled hospitals to dedicate a full-time resource to technology and knowledge transfer and/or participate in a network that gives them access to the tools, know how and expertise of large university TTOs/ILOs. Hospital researchers have indicated that their level of satisfaction with the services provided by their TTOs/ILOs has increased in recent years, which should encourage the use of the offices' services. Third, some IPM sponsored pilot or demonstration projects have focused on the medical field. The projects have increased researcher collaboration with potential users of

[10] For purposes of the evaluation, knowledge transfer refers to influencing policy and enhancing general public knowledge.

research results and, by doing so, bridged a difficult gap in the technology transfer process.

The initial impact of CIHR joining IPM and extending program funding to research hospitals was a significant increase in program funding. A review of the IPM grants database reveals that there was a large increase in program funding devoted to grants due to the inclusion of CIHR in 2001. In the 1998 competition, when IPM was entirely funded by NSERC, 26 grants totaling $8.8M were awarded. In 2001, this increased to 38 grants totaling $13.3M, of which CIHR accounted for $5.9M. For five of these grants, CIHR was the sole funding agency. In the 2005 competition, CIHR accounted for close to 50% of the $16.6M in grants awarded by the program.

As a result of CIHR joining the IPM program, research hospitals became eligible to receive IPM grants. Findings from the mini-case studies indicate that research hospitals used IPM funding to either establish a permanent technology transfer officer in hospitals, where one had not existed previously, or increase the number of officers. Mini-case studies revealed that the objective of hospitals in hiring these officers was to reach a large number of researchers who either previously had no one in their hospital to approach with invention disclosures, or faced slow response times from their TTO/ILO. For example, IPM funding permitted Toronto area hospitals and Vancouver area hospitals to dedicate at least one additional full time resource to technology and knowledge transfer. Increased invention disclosure and over time, increased commercialization activity is expected. Other research hospitals, particularly those in Quebec, have benefited from IPM group grants which have funded networking with more sophisticated university TTOs and provided the research hospitals with IP policies, procedure manuals, and general know how that was unavailable to them previously.

The responses of hospital researchers surveyed are consistent with the findings of mini case studies and suggest that the focus of hospital researchers is technology transfer rather than knowledge transfer. Sixty percent of researchers report they are significantly more involved in technology transfer compared with five years ago and 23.1% are moderately more involved. Figures were much lower for researcher participation in knowledge transfer,

with only 23.1% indicating they are significantly more involved and 15.4% moderately more involved.

In addition, survey findings indicate that IPM funding has had a positive impact on the ability of hospitals to mobilize their IP. Twenty-seven percent of hospital researchers responded through the survey that the impact of this funding was significant on their ability to transfer results to the user sector, while another 63.6% indicated that the impact was moderate. The views of surveyed TTO/ILO Directors located within hospitals are consistent with the views of hospital researchers and the mini-case study findings that IPM has improved the overall capacity of hospitals to mobilize IP. Seventy-five percent responded that IPM had a significant impact on their hospital's overall ability to mobilize IP, and the remaining 25% indicated that the impact was moderate.

For the most part, hospital researchers also indicated that their level of satisfaction with the services provided by their TTO has improved in the last five years, suggesting that the additional officers have had the desired effect. Nearly half (47%) indicated that service levels had significantly improved and no respondents reported that service levels had deteriorated.

Key informants could not speak directly to results, but raised some important issues related to the inclusion of CIHR in the IPM program. First, the inclusion has enabled CIHR to serve an emerging community of TTOs/ILOs at hospitals that are ineligible for NSERC funding. Second, some representatives from CIHR are concerned that the IPM program is still viewed as an NSERC program by funding recipients and feel that this perception needs to be addressed otherwise it will hurt the ability of CIHR to allocate future funding for the program.

Issue 5b: What percentage of TT/KT activities carried out by the institutions pertains directly to the specific domains of CIHR, NSERC, and SSHRC?

Finding 5b: According to survey respondents, about 50% of activities fall under the NSERC domain, about 33% under CIHR, and about 10% under SSHRC. There are sharp differences however, between research hospitals,

where 75% of activity falls under the CIHR domain, and universities and colleges, where nearly 70% of activity falls under the NSERC domain.

Mini-case studies suggested that the bulk of institutional technology transfer and knowledge mobilization activity pertains to the domains of NSERC and CIHR. Activities that fall under the mandate of SSHRC are considerably less frequent.

The survey of TTO/ILO Directors asked respondents to estimate what percentage of technology and knowledge transfer activities pertain to the mandates of the three granting agencies (see Exhibit 3.17). At universities and colleges, TTO/ILO Directors indicate that the majority of activities pertain to NSERC (68.6%), while at research hospitals the majority of activities (75%) pertain to the domain of CIHR.

Exhibit 3.17 – Share of Technology Transfer/Knowledge Transfer Activities Falling Under the Domains of Granting Agencies

	Universities & Colleges (n=19)	Research Hospitals (n=8)	Overall (n=27)
NSERC	68.6%	5.6%	50.0%
CIHR	15.4%	75.0%	33.0%
SSHRC	14.2%	2.1%	10.1%

Note: CIHR, NSERC, and CIHR percentages do not sum to 100% because some respondents entered percentages that did not add to 100%
Source: TTO/ILO Director survey (n=29)

Issue 5c: To what extent have knowledge mobilization[11] (vs. technology transfer) activities been carried out by IPM grantee institutions since the scope of the program was first expanded? To what extent are the notions of technology transfer and knowledge mobilization complementary to each other, or not, within the context of the IPM program?

Finding 5c: The evaluation found that the amount of funding directed toward knowledge mobilization activities has been very small. The question of

whether IPM has positively impacted the level of knowledge mobilization is difficult to answer. There are few statistics available as there are for technology transfer, and there appears to be some ambiguity among stakeholders as to what constitutes knowledge transfer. Nevertheless, the evaluation found that TTOs/ILOs perceive they are well suited to handle knowledge mobilization efforts, with about 80% of surveyed TTO/ILO Directors indicating that their offices currently handle it. The mini-case studies provided some anecdotal evidence of increased knowledge transfer activities, and the survey revealed that TTO/ILO Directors feel that IPM has positively impacted these activities.

Based on evidence from mini-case studies, survey responses, and a review of the IPM grant database, evaluators concluded that knowledge mobilization activities have not increased to a great extent since the program was expanded in 2001. There are several reasons why knowledge mobilization activities have not increased to the extent that technology transfer activities have.

First, the amount of funding directed toward knowledge mobilization has been small. A review of the IPM grant database revealed that SSHRC contributions to IPM grants amounted to just $24,000 of a $675,000 grant and $26,000 of a $375,000 grant in 2001. In 2005, SSHRC contributed $380,000 toward four grants totaling $3.1M.

Second, there are several obstacles that TTO/ILO Directors encounter in attempting to carry out successful knowledge transfer. The mini-case studies revealed that some TTO/ILO Directors find that researchers lack understanding of knowledge transfer and copyright laws, and lack knowledge and experience about knowledge transfer in general within TTOs/ILOs. It was pointed out that knowledge transfer is at a much earlier stage of development compared with technology transfer. For instance, even the definition of knowledge transfer is not always clear–a survey respondent pointed out that the definition used in the evaluation survey differs from the definition used by some offices. The evaluation survey supported the mini-case study findings surrounding the ambiguity of knowledge transfer. When asked the survey

[11] In survey questionnaires and interviews, knowledge mobilization and knowledge transfer referred to "influencing policy and enhancing general public knowledge"

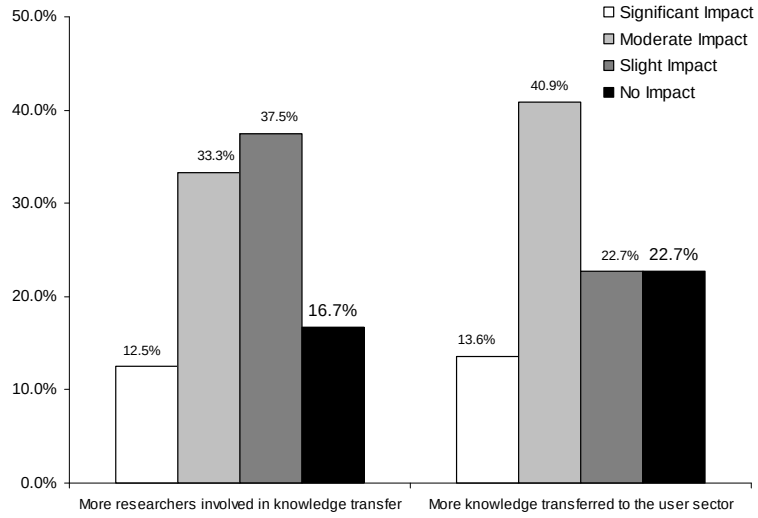
question, “do you handle knowledge transfer as well as technology transfer”, 11% of Directors responded “do not know” indicating a lack of certainty of what knowledge transfer exactly constitutes.

Despite these obstacles, TTO/ILO Directors and key informants agreed that knowledge mobilization can be handled well by technology transfer offices, as the office infrastructure (e.g., personnel, office set-up and presence/position within the university) is suited to support it. Key informants in particular stated that knowledge mobilization needs the infrastructure of the TTO/ILO and its connections and knowledge to grow.

It is difficult to measure the precise increase in knowledge mobilization activity, since baseline activity was not measured prior to IPM program expansion, and knowledge transfer lacks the quantifiable measures associated with technology transfer. The mini-case studies suggest there has been some increased activity since the inclusion of SSHRC. For example, the mini-case study of an Ontario university revealed it increased its outreach activities in the area of knowledge mobilization, and IPM funded a rather large knowledge mobilization project undertaken by this university and a Pacific university. Priority is often placed on finding applications for the knowledge whether or not they lead to commercial revenues. TTOs/ILOs of mini-case study participants that are separate entities appear to focus less on knowledge mobilization than those housed within the university.

Surveys of TTO/ILO Directors also provided some insight as to the extent that IPM has stimulated knowledge transfer activities. Currently, about 80% of TTO/ILO Directors surveyed indicated that their office handle knowledge transfer. As illustrated in Exhibit 3.18, TTO/ILO Directors feel that IPM has helped to increase the number of researchers involved in knowledge transfer at their institutions, and helped to transfer more knowledge to the user sector in the last five years.

Exhibit 3.18 – IPM Impacts on Knowledge Transfer



Source: TTO/ILO Directors survey (n=29)

Interview findings provided some additional insight into the role of SSHRC and knowledge transfer in the IPM program. Some interviewees are concerned that SSHRC objectives can be lost when collaborating in some IPM projects. Specifically, interviewees indicate that the project objectives are dominated by NSERC and CIHR, when SSHRC contributions toward projects are relatively small. Furthermore, the review of progress reports for projects involving SSHRC contributions did not appear to speak to SSHRC objectives. Despite its modest financial investment in IPM, NSERC and CIHR have been inclusive and have treated SSHRC as an equal in the program.

A mini-case study of an Ontario university permitted evaluators to discuss the only significant project in knowledge mobilization funded by IPM. The purpose of the grant was to support the development and testing of a knowledge mobilization unit for the social sciences and humanities with the following components:

- A knowledge broker to develop a service similar to technology transfer seeking to match up health researchers with key stakeholders in health and social service agencies and government policy makers; and

- An interactive web site, on-line tools and broadband networks to allow key stakeholders and government policy makers to identify academic research and researchers of interest.

One interesting outcome of the IPM program appears to be its influence on SSHRC programming. Interviews revealed that the IPM program encouraged SSHRC to look at other funding mechanisms for knowledge mobilization, which led to the launch of the Knowledge Impact in Society program in 2005.

Issue 6: What have been the impediments to the program's objectives?

Finding 6: Some researcher resistance to commercializing research results and a tendency of institutions to offer stand alone rather than bundled technologies to receptors have impeded IPM objectives. More results could also likely be achieved with higher IPM funding levels, particularly funding for pilot or demonstration projects. The interdependency of various programs at the provincial and regional levels with respect to secured funding can cause funding to be delayed for offices located in some provinces.

There are several impediments to the success of IPM. First, there is a portion of researchers that are ambivalent or opposed to commercializing their research results. As institutions hire more researchers that are interested in commercializing their research results, this impediment should become less significant over time.

Second, some institutions continue to offer one-off technologies to potential users rather than bundling technologies, which are generally more likely to attract investment.

Third, TTO/ILO Directors interviewed over the course of conducting the mini-case believe that they could accomplish more with higher funding levels. In particular, there is a tremendous need for funding to bridge the gap between invention disclosure and the point where the technology has been advanced far enough to interest the private sector. At present, TTO/ILO Directors and researchers indicate that many promising inventions die in this gap.

Fourth, the timing of IPM applications can be challenging. Some TTO/ILO Directors felt that the timing of applications submitted to IPM should be coordinated with compatible provincial grant programs (or vice versa), although it may be unrealistic to expect a federal program to coordinate its application timelines with that of several different provincial programs.

Finally, the requirement that recipients contribute 50% of the cost of activities funded by IPM can be cumbersome for institutions, particularly those located in Ontario, Alberta, and BC. Some institutions do not have sufficient base institutional funding to match IPM funding, and therefore must seek alternative funding sources for their contribution. This alternative funding often comes from provincial and regional programs. For example, the interdependent nature of cost-sharing has caused some funding delays to institutions located in Alberta and Ontario. Some colleges in Alberta receive provincial funds to support particular projects and faculty, and believe that IPM funding and being part of a network is important in helping them obtain provincial funding. Furthermore, BC institutions obtain support from the BC Innovation Council and, although matching funds is not a requirement for this program, IPM funding may be taken into account and add strength to the application. A BC institution also mentioned that matching funds were a requirement for the support they received from WED. A TTO Director reported that a delay in receiving ORCP funding postponed the hiring of a commercialization officer at his office Ontario. On this point, it should be noted that the IPM program maintains that it did in fact release IPM funds despite the fact that some Ontario universities had not yet received their provincial funding.

3.3 Cost Effectiveness

Issue 7: To what extent is the delivery model for the IPM program cost effective? To what extent are the institutions receiving IPM funds meeting their commitments to the program (e.g., cost sharing)?

<u>Finding 7:</u> Evidence from the evaluation indicates that the IPM program is well managed and has a lean delivery model. There is significant cost sharing by institutions. Most of the significant regional and provincial programs that provide funding to TTOs/ILOs require funding to be cost shared.

Research conducted at Canadian universities, colleges, and hospitals has a significant impact on the economic and social well being of Canadians. There are several success stories, particularly in the biomedical field. As one of several funding sources that support the efforts of institutional technology transfer offices, IPM has contributed to the success to date.

A comparison of granting agency programs focused on innovation revealed that administrative costs are not available at the level of individual programs. Typically, administrative costs represent 5% of granting agency expenditures, with cost sharing and leveraging across programs. Overall, available evaluation evidence indicates that the IPM Program's administrative component is very lean as it is administered by a partial person year. Also, IPM requires applicants to cost share funding through financial or in-kind contributions that can come from the either the institution's base budget or from other sources such as provincial and regional economic programs.

The evaluation found that interviewees believe that IPM is run in a cost effective manner. They point to its lean administrative structure, and the fact that there are follow up activities that the program does not have staff resources to pursue. Some examples include: outreach and interaction with clients and other federal agencies that support knowledge and technology transfer; and working out common metrics with AUTM and ACCT for measuring technology and knowledge transfer. Furthermore, TTO Directors seemed to be content with the way IPM is managed with just 0.5 FTE; they indicate that the program could not likely get by with fewer administrative resources. That said, TTO/ILO Directors would welcome a reduction of administrative/reporting burden.

The views of key informants are supported by available administrative cost data, which can be used to provide an approximation of the cost-efficiency (i.e., cost per output) or operational efficiency of the program. The overall administrative costs for NSERC's Research Partnerships Programs, the

division in which the IPM Program is located, are low. The RPP's average administration cost per dollar awarded was $0.046 over the period from 2002-03 to 2006-07. As noted, it is not possible to provide the administrative costs for the IPM Program because this cost information is not available at the level of an individual program. Based on the operations and staffing level of the IPM program, it is reasonable to expect that its administrative costs would be lower than the administrative costs for RPP because the program is managed by 0.5 FTE and holds periodic rather than annual grant competitions. Further, an estimate of direct administrative costs for the program (i.e., personnel costs and costs associated with administering the grant competition) expressed as a percentage of total dollars awarded by the IPM program were less than 1% for the last three funding years in which funding was awarded (2002, 2004 and 2005).

Based on Statistics Canada 2005 survey of IP Commercialization in the Higher Education Sector, universities and hospitals have earned more than $200M in commercialization revenues between 1999 and 2005 – up from just $21M in 1999 to more than $55M in 2005. Assuming a conservative 5% royalty rate, the revenues from sales of commercialized technologies would total approximately $4B over this period. This represents significant incremental economic benefit to Canada, in terms of profits earned by firms, tax revenues flowing to government, and employment.

Although the impact of the IPM program cannot be precisely determined, if it contributed to only a small fraction of the growth in commercialization revenues experienced, it would have yielded a substantial return on the $47M granted by the program to date.

4.0 Conclusions and Recommendations

This section concludes on three main objectives of the IPM evaluation:

- To determine if the IPM program has evolved in an appropriate manner (the right mix of objectives, funding streams, and partners);
- To determine the impact of the IPM program to date; and,
- To determine if the IPM program is still necessary, and if it is, the form that it should take in the future to ensure it is most effective.

4.1 Has the IPM Program Evolved Appropriately?

The launch of the IPM program originated from a program proposal put forth by the Canadian University Intellectual Property Group (CUIPG) to address the lack of university funding to accelerate technology transfer. Given that the impetus for creating IPM came directly from Canadian universities, there was strong demand for the program from the outset. One of the strengths of the IPM program design has been the provision of funding in the form of grants which allow TTO/ILO Directors to tailor the use of IPM funds to meet the specific needs of their office.

In 2001, CIHR joined the IPM program, marking two important changes. First, the inclusion of CIHR recognized that there was untapped demand from the health research community, and promising inventions with potentially significant health benefits for Canadians were not being commercialized. CIHR brought a significant funding increase to IPM and program demand jumped accordingly, up 51% from the 1998 competition. Findings from the evaluation show that hospital researcher participation rates have increased substantially from five years ago, confirming the appropriateness of the program design change.

SSHRC also joined the IPM program in 2001, reflecting the need to widen the focus of IPM beyond commercialization to include knowledge mobilization.

TTO/ILOs provide an established structure and skilled staff that should assist knowledge mobilization to grow in Canadian institutions. The impact of SSHRC joining IPM has been less clear than the impact of CIHR, however. There would appear to be some anecdotal evidence of increased knowledge transfer activities in recent years due to IPM, however, the main focus of offices remains technology transfer.

In 2002, the scope of the program expanded to include networked training in order to increase the pool of trained technology transfer personnel with hands-on experience available to academic institutions. Evaluation evidence indicates that the evolution of IPM to include the funding of regional training programs has been appropriate to address several pressing challenges faced by TTO/ILOs, such as a lack of staff, skill deficiencies, and staff attrition. In reality, networked training has had wider reaching impacts than its original intended objectives. For example, as a result of relationships forged over six and eight month internships, and reinforced through networking conferences and meetings, training program graduates employed at TTOs/ILOs, venture capital firms, and technology companies have developed a better understanding of each type of organization, and created closer ties between these organizations. As a result of these connections, commercialization deals are occurring that might not have occurred otherwise.

In 2005, individual awards to institutions were discontinued in favour of awards to groups of institutions. Many of the benefits of group awards have flowed to small institutions that have benefited from the expertise of larger institutions, but sophisticated institutions have benefited as well. The redesign of IPM to encourage networking seems timely given that collaborations among universities, hospitals, colleges, and centres of excellence are expected to become more important and prevalent in the future. In fact, networks and the Networks of Centres of Excellence are specifically identified as priorities in the Government of Canada's science and technology strategy, *Mobilizing Science and Technology to Canada's Advantage*.

The 2005 design change also expanded IPM funding to Canadian colleges. While it is too early yet to fully understand the impact of this change, available evidence from the evaluation suggests that the colleges have much to gain from participating in networks with larger and more sophisticated technology

transfer offices of universities. In addition, colleges have applied technical capabilities that appeal to private sector firms interested in the co-development of technologies.

Despite the launch of a number of federal, provincial, regional, and municipal programs aimed at increasing the commercialization of institutional research, IPM remains relatively unique. There is no other program that offers infrastructure support directly to technology transfer offices right across Canada. IPM is not the only program that provides financial support to bridge the gap between invention disclosure and technology transfer, however, federal, provincial and regional technology transfer programs, in contrast, tend to provide funding for technologies that have been developed further and have already attracted industry partners.

Conclusion 1: The evolution of IPM has been appropriate. The inclusion of CIHR and SSHRC; the decision to fund regional training programs and colleges; and the discontinuation of individual IPM awards in favour of group awards have all positively impacted the effectiveness of the program and contributed toward accelerated technology and knowledge transfer. Despite the proliferation of a number of programs in recent years aimed at commercializing research, the design of IPM remains relatively unique, with few examples of overlap.

4.2 What Has Been the Program's Impact?

A recent report by the Association of Universities and Colleges of Canada (AUCC) provides some insight into the economic and social impacts that university R&D has on Canada. These insights provide some sense of the potentially large return on investment that programs, which assist universities to transfer knowledge and technology, can have. The report titled *Momentum: The 2005 report on university research and knowledge transfer* estimates the dynamic impact of university R&D on Canadian GDP at about $50 billion. It also states that universities have conducted more than $5.2 billion worth of research commissioned by the private sector, and that university spin-off companies alone have generated almost 20,000 jobs in 2002 as well as $2.5 billion in annual sales.

Statistics Canada data and evidence gathered from the evaluation survey and the mini-case studies confirm that the technology transferred from universities and hospitals has increased dramatically in the last decade. Evidence of this increase is partly reflected in data showing that the commercialization revenue of universities and hospitals increased from $21 million to $55 million between 1999 and 2005.

The share of this increase that is attributable to the IPM program is difficult to estimate because IPM is one of many funding sources that support the activities of TTOs/ILOs across Canada. Based on discussions with TTO/ILO Directors over the course of conducting the evaluation, it became evident to evaluators that the impacts of the IPM program could not be quantified. While unable to quantify the program's impact exactly, the evaluation did reveal that the program has been a factor in the growth of knowledge and technology transfer activities at Canadian institutions and identifies areas in which the program's impacts have been the greatest.

The evaluation revealed that technology and knowledge transfer is a labour intensive business, and IPM funding has played an important role in helping offices to address insufficient staffing levels. Salary support has been critical for small universities, by either supporting the position of the TTO/ILO Director, or an additional commercialization officer. Salary support has also been particularly critical at hospitals, many of which previously had no dedicated full-time resource to conduct technology transfer activities.

Technology and knowledge transfer requires highly skilled personnel, preferably with a mix of scientific and business experience. IPM has assisted institutions to develop the skills of TTO/ILO staff by providing funding for professional development initiatives. The most significant initiative has been regional internship training programs, which provide several benefits. Specifically, the program provides: a relatively standardized approach to developing interns into technology transfer professionals; an effective mechanism to attract qualified candidates; and an opportunity for TTO/ILOs to evaluate the potential of a candidate over many months at low cost, without the obligation to hire them. The immediate impact of IPM supported training activities, and the subsequent hiring of interns, has been some improvement in

TTO/ILO service levels (e.g., response times and legal services), which have been acknowledged by both researchers and IP receptors. Internship training programs will play an important role in the future, as they help to create relationships between institutions, venture capital firms, and technology firms; and help to combat the effects of employee attrition and retirement.

The evaluation found that networks permit exploitation of the economies of scale in technology transfer, allowing smaller institutions to take advantage of the expertise and specialized knowledge of commercialization officers at larger institutions and their well-developed processes for the evaluation, patenting and licensing of technologies. Networks have encouraged interaction between the members of the network and led to the sharing of information and best practices between members, both of which work to increase the likelihood of commercialization. In addition, networks have brought together researchers with common research interests that have led to the development of better technologies, and linked researchers with IP receptors that, in the absence of the network, would likely have not met.

Conclusion 2: IPM has contributed to the acceleration of technology and knowledge transfer witnessed in Canada in the last decade; however, the share attributable to IPM cannot be quantified. The program's contribution has been greatest in terms of increasing staffing levels and developing the skills of IP professionals so that TTO/ILOs could be more effective. The other significant contribution of IPM has been the encouragement of institutional networking, which has enabled smaller institutions to access and use the knowledge and expertise of TTOs/ILOs at larger institutions, and to develop closer relationships between researchers, IP receptors, and TTO/ILOs.

4.3 Is the Program Still Necessary? What Form Should it Take in the Future?

The evaluation found several reasons why the IPM program is still necessary. First, the budgets of universities and hospitals are stretched and most have very small commercialization revenues. Additionally, demand for the program has

increased over time. The number of applications and the volume of funding requested continue to grow with each competition. At the moment, technology transfer offices are trying to accommodate higher volumes of invention disclosures flowing from increased investment in research at Canadian institutions. Although a number of programs at the provincial and regional level that address innovation have sprung up in recent years, the IPM program remains the only source of funding to build TTO/ILO capacity for all institutions across Canada. The evaluation found that the loss of IPM funding would have consequences even for sophisticated technology transfer offices with relatively large budgets. These consequences include staff cutbacks, some decline in service standards, increased difficulty in identifying and hiring qualified personnel to counter the effects of turnover and retirements, and reduced commitment to new initiatives such as Entrepreneur in Residence programs. For small offices, the suspension of IPM funding could have severe impacts on the progress they have made to date, or in some cases, it may force small offices to close altogether.

Conclusion 3: If the IPM program were discontinued, and its funding not replaced by another source, the current pace of technology and knowledge transfer of institutional research in Canada would be reduced. The extent to which the pace would be reduced cannot be exactly quantified, however, the widespread use of IPM funding to retain, hire, and train commercialization officers suggests that IPM is an important driver of the pace of commercialization within Canadian institutions.

4.4 Recommendations for the Future of IPM

As for the form the IPM program should take in the future, it should maintain a lean administrative structure; however, human resource levels should be sufficient to enable the program to undertake necessary follow-up activities that the program has not addressed, such as outreach with clients and partners.

The flexibility in which IPM funds can be used should be maintained, as it is a strong feature of the program's design. TTO/ILO Directors and VPs of Research are highly experienced people who best know how to use resources to most effectively transfer institutional IP to the user sector. The program design

should reflect the needs of institutions, namely funding for hiring, retaining, and training personnel, demonstration projects, networking, and internship training programs. In particular, the program's support of salaries of IP professionals is widespread and critical to building and maintaining the capacity of TTO/ILOs.

In addition, the program's future design should reflect the trends that we are currently seeing in technology transfer and knowledge mobilization. Those trends consist of more institutions working together; increasingly complex disclosures and technology, which are more time consuming for TTO/ILOs to evaluate and manage; increased knowledge mobilization activities by social science researchers; and, the likelihood that more technology transfer offices will be spun out of institutions. In light of these trends, IPM as currently designed, is appropriate, hence the evaluation team would caution against significant design changes at the moment.

Recommendation 1: The IPM program should be continued. The design of the program should continue to encourage TTO/ILOs to network with other institutions and pursue knowledge mobilization activities. Salary support for IP professionals should remain an eligible cost in the IPM design.

The evaluation found that institutions in close geographic proximity, rather than those with complementary research strengths submit most IPM group applications. Institutions with strength in a particular research area should be encouraged to pool their expertise and resources, regardless of geographic distance. This could offer an advantage to the private sector – knowledge comes from one coordinated source, and there is better filtering and analysis of discoveries before the TTOs approach potential receptors.

Recommendation 2: The program should encourage applications from institutions with complementary research strengths in addition to applications based on geographic proximity.

It is important that the IPM program management understands the implications from requiring institutions to contribute at least half of the cost of activities proposed in an IPM application. Many of the institutions that participated in

the case studies do not have sufficient base funding to match IPM funds, and are forced to find alternative funding sources such as provincial or regional grant programs. This requirement poses an administrative burden on TTO/ILOs, whose staff can spend a considerable amount of valuable time finding and securing funds to contribute their share of costs associated with the activities proposed in an IPM application. In addition, in certain provinces the receipt of IPM funds may be delayed when a complementary source of funding is delayed. The evaluation found this to be the case for institutions in Ontario and BC.

Recommendation 3: If the granting agencies strongly believe in the need to support technology and knowledge transfer at Canadian institutions, they should consider either reducing the IPM cost share ratio below 50-50 or make exceptions for some applications, to recognize the significant challenge that institutions face in contributing at least half of the funding required to conduct activities proposed in IPM applications.

There are overhead costs associated with conducting research (e.g., management and administration costs) and commercializing research (e.g., patent costs, market studies). Private sector firms currently pay overhead charges directly to technology transfer offices for the institutional research they co-fund. It is therefore logical for the IPM budget to reflect a percentage of NSERC, CIHR, and perhaps SSHRC research funding to institutions in recognition of the overhead costs imposed by funded research. Although the federal granting agencies' Indirect Costs Program is intended to address these increases to some extent, the evaluation found that just 6% of Indirect Costs Program funding is directed into TTO/ILO budgets. In light of recent increases in research funding from the granting agencies, it also seems logical that IPM funding should increase over time.

The Committee on Research Partnerships has recently recommended that NSERC make a commitment to fund its technology transfer programs at a level equal to 3% of its research grant budget. Because IPM is one of several technology transfer programs, there is some risk that IPM may not receive its fair share. At the moment, however, the program could not likely distribute additional funding since the value of proposals deemed worthy of funding in the last competition was less than the value of available funding. A disconnect

therefore exists between TTO/ILOs which need additional funding and the grant funding approach currently taken by the granting agencies.

Recommendation 4: IPM program management should consider investigating why applications are not exhausting available IPM funding. The program may wish to consider meeting with TTO/ILO Directors to understand why. The program may need to invest in additional managerial resources to conduct such an exercise.

Recommendation 5: Assuming that funding in future competitions can be exhausted, NSERC should then consider pegging IPM funding at a fixed percentage of its research grants budget. CIHR and SSHRC should consider adopting a similar commitment to IPM funding levels.

Appendix A – Documents Reviewed

1. Program descriptions of IPM program (1995-present)
2. Templates of progress and final reports
3. Program Proposal: Accelerating Utilization of University Research by Canadian Universities, Canadian University Intellectual Property Group (1993)
4. Community Consultation on Proposed NSERDC Program (undated)
5. Survey on the Intellectual Property Mobilization Program (May 2004)
6. Commercialization and Knowledge Transfer, Recent Developments, Mireille Brochu, 2001
7. Commercialization Strategies of Canadian Universities and Colleges: Challenges at the University/College Interface, Including Intellectual Property Policies, Dr. Chris Riddle, 2004
8. Survey of Intellectual Property Commercialization in the Higher Education Sector, Statistics Canada (5 surveys: 1998, 1999, 2001, 2003, 2004)
9. Commercialization of Intellectual Property in the Higher Education Sector: A Feasibility Study, Statistics Canada, 1997
10. Commercialization Report: Summary of Institutional Activities on the Commercialization of Research, Canadian Foundation for Innovation, (3 reports: 2002, 2003, 2004)
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