



Advisory Council  
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Technology

Conseil consultatif  
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# Public Investments in University Research: Reaping the Benefits

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Report of the Expert Panel  
on the Commercialization  
of University Research

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on the Commercialization  
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Presented to:

The Prime Minister's Advisory Council  
on Science and Technology

May 4, 1999

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la technologie

## Expert Panel on the Commercialization of University Research

May 4, 1999

Dr. Gilles G. Cloutier  
Deputy Chair – Advisory Council on Science and Technology  
235 Queen Street, 8th Floor West, Room 824D  
Ottawa, Ontario  
K1A 0H5

Dear Dr. Cloutier:

We have the pleasure of submitting to you our report entitled *Public Investments in University Research: Reaping the Benefits*. The report contains our unanimous conclusions and recommendations to maximize the social and economic benefits to Canada from public investments in university research.

We wish to thank you for the confidence you have placed in us. It is our hope that the recommendations contained herein will assist in strengthening Canada's system of innovation.

Yours sincerely,

Mr. Pierre Fortier,  
Chair

Dr. Thomas A. Brzustowski

Dr. Robert C. Miller Jr.

Mr. Denis N. Beaudry

Mr. René Douville

Dr. James W. Murray

Mr. Michael Brown

Dr. Julia Levy

Dr. Claudine Simson

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## Chair's Message

The Expert Panel on the Commercialization of University Research was established in October 1998 by the Prime Minister's Advisory Council on Science and Technology. Our mandate was to present a vision and implementation strategy to maximize the economic and social returns to Canada from public investments in university research.

It was my pleasure to chair the Panel and to have had the opportunity to work with eight eminently qualified individuals. Each member of the Panel has extensive experience working directly with universities to commercialize research results. Our experiences and perspectives represent a diverse range of interests, with representation by technology transfer practitioners in Canada and the United States, venture capitalists, industry, and the federal government. The members of the Panel contributed in their personal capacities, and not as representatives of their organization or interest group.

In the first phase of our work, we commissioned background papers to ensure that we had access to the most relevant data and information available on the topic. We also solicited written submissions from those most involved in the process of commercializing university research to benefit from their experience and insights. On the basis of this information, we then prepared a draft report. We sought feedback on the draft report through consultations in eight cities with over 100 senior representatives from the public, academic and industrial sectors. I am pleased to note that this final report responds to many of the issues raised by those we consulted, and that there would appear to be a broad base of support for our findings.

In the global knowledge-based economy, Canadians' standard of living is driven by our capacity to create and successfully apply new knowledge. To succeed in the 21st century, universities need to become a driving force in translating new scientific discoveries into new economic and social opportunities for Canadians across the country. The Panel is confident that the recommendations contained herein provide the blueprint to position Canada as a world leader in reaping the benefits from its investment in university research.

Yours sincerely,



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Mr. Pierre Fortier  
Chair, Expert Panel on the Commercialization  
of University Research

## Acknowledgments

We are grateful to the many individuals who helped shape the orientation of this report. First, we wish to sincerely thank the researchers and consultants who prepared background reports for our consideration, and who took the time to meet with us to present their findings. We were most impressed with the knowledge and commitment of Mireille Brochu, Wulong Gu, Jeremy Howells, Carole McKinlay, Geoffrey Nimmo, David Norwood, Dennis Rank, Niels Reimers, Jennifer Ryan, Gerry Tertzakian, Lori Whewell and Janusz Zieminski. (A list of the background reports can be found in Annex 1.)

We are also grateful to the many individuals who took the time to prepare detailed submissions for our consideration. Many of these same individuals, too numerous to mention by name, also participated in the consultations we hosted across the country. Their insight and advice were constructive and proved most valuable in strengthening the final version of our report.

Finally, we wish to thank the members of our Secretariat for all their hard work in helping us to prepare this report under very tight timelines. We are grateful for the support provided by Karen Corkery, Angie Brennand and Christine Claessen.

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# Executive Summary

Canada's standard of living has been slipping relative to the standard of living in the United States and other countries over the last two decades. There are many reasons for this, and many different measures will have to be taken to reverse this trend.

This report is about one such measure. It proposes actions that will greatly increase Canada's ability to deploy the intellectual property created in university research to contribute to wealth creation in the Canadian economy. The proposed actions necessarily focus on university research supported with federal funds, but it is our hope that research supported with public funds from all other sources will be accorded the same treatment.

Universities are a very important element of Canada's innovation system. Their most visible contribution is in the education of people who acquire the knowledge and skills that enable them to contribute to their society in a great many ways. However, their contribution as centres of research is very important as well. The recommendations in this report are intended to strengthen the role of university research in Canada's innovation system.

## The Focus and the Terminology

This report is focussed on just one element of the contribution of universities to Canada's innovation system, but one that we consider very important. It deals with the process for developing new goods and services for the market from those inventions and discoveries made by university researchers that are judged to have the potential for commercialization. We call this research-based innovation originating in the universities.

When we use the term "innovation" in this report we mean the following:

**innovation:** the process of bringing new goods and services to market, or the result of that process.

We will also refer to intellectual property resulting from federally funded research. We will explicitly exclude intellectual property created without federal funding, which should be left to the universities and the private sector to negotiate on a case-by-case basis. We will also explicitly not include in that term either journal articles or scholarly books written by university authors. There are established traditions and practices for dealing with scholarly publications, and it is not our intention to recommend that they be changed in any way.

In this report the term intellectual property will mean the following:

**intellectual property (IP):** an invention, discovery or new idea that the legal entity responsible for commercialization has decided to protect for possible commercial gain, based on the disclosure of the creator. This definition is intended to exclude journal articles and scholarly books, and IP created without federal funding.

This definition makes it very clear that we are interested only in those forms of intellectual property that can be protected for possible commercialization. It also underlines the fact that it is up to the creator to decide whether an invention, discovery or new idea is to be treated as IP. For example, a researcher who immediately publishes a discovery has made the decision that it is not to be treated as IP. Our recommendations do not infringe on researchers' rights to publish.

## The Main Directions

Everything that follows begins with the people who create inventions, discoveries or new ideas in the course of their research at Canadian universities. We are acutely aware that their time is a scarce and precious resource.

The overriding objective of our recommendations is to increase the return to Canada on the investment in university research made by Canadian taxpayers. That goal is not in dispute. We believe that research-based innovation originating in universities has the potential to contribute much more than it does now in a form that is very important to all Canadians, namely well-paying new jobs.

We understand that most university researchers are not entrepreneurs, and that they do not want to learn how to become entrepreneurs in order to take a promising invention or discovery to market. They are skilled at research, and they believe that their time is used better in doing more research than in learning how to start a business. But we also understand that there may be some researchers who have the aptitude and taste for entrepreneurship, and who might be the best people to commercialize their own inventions. Our recommendations address the needs of both groups.

At issue is the commercialization of discoveries and inventions that are the result of research in Canada's universities. It is understood that a great deal of university research is basic research whose goals have nothing to do with the development of marketable products. Provided that basic research meets high standards of excellence, it is valuable in many ways. In the present context, it builds the foundation for important future innovations whose shape cannot even be foreseen today. And on the flip side of that same coin, it may show that certain lines

of industrial research and development (R&D) would be dead ends, thereby saving industry a great deal of time and money. However, publicly funded university research also produces discoveries and inventions that immediately show the potential to be developed into new goods and services for the market. Enhancing Canada's ability to obtain economic benefit from such results is the objective of the actions recommended in this report.

Canadian universities also engage in a great deal of project research in partnership with industry. The economic benefit from that research is more easily obtained, since the industrial partners share in the funding of the work in the clear expectation of a significant economic return. Innovation resulting from project research takes place through established channels, and is assisted by the eventual employment of research students who were engaged in the projects. This process is working so well across the country and in all sectors of the economy that it should be considered a national success. For this reason, we are not preoccupied with project research in this report, although some of our recommendations will have an impact in this area.

Let us now be very clear in stating the main goal of the proposed actions. It is to increase wealth creation in Canada; it is not primarily to produce new revenue streams for universities. The experience in the United States, which we use as a benchmark in this report, is that in the vast majority of research universities the revenues from commercializing research constitute a small addition to university budgets, generally well below 1 percent. It would not be realistic to expect much more in Canada. That amount of incremental income might be sufficient to provide useful incentives to the researchers involved, and to pay some of the cost of managing IP, but it could not be counted on to relieve the financial pressures that Canadian universities face today. Discoveries that produce financial bonanzas are so rare that policies designed to pursue them would almost always lead to failure.

However, if policies are designed to make university research the source of new value-added activities in the Canadian economy, we believe that the potential benefit is much greater. Canadian universities are a very important element of our national capacity for innovation. They perform 21 percent<sup>1</sup> of all Canadian R&D, account for 31 percent<sup>2</sup> of Canada's R&D personnel, generate 65 percent<sup>3</sup> of Canadian scientific publications, conduct research of world-class quality, and train many highly skilled people

who can function at the leading edge of important technologies. That all adds up to a great potential to play a crucial role in the transformation of Canada's economy into one that thrives on innovation and value-added activities in all sectors. In return, greater prosperity in the nation, achieved with a visible contribution by universities, could be expected to produce increased public support for these institutions.

## Recommendations

Our first recommendation makes explicit the expectation that if any commercial activity is created from the results of research supported by the Canadian public, that commercial activity must bring a benefit to Canada. Presently, university researchers are under no obligation to act in the national interest if they decide to commercialize IP created with federal funding.

It would be best if Canadian companies had the capacity to receive and make good use of all research-based innovations that come out of the universities. The benefit to Canada would come in obvious ways from the success of these companies. The Canadian receptor capacity is substantial, but not as extensive as it needs to be.

One way of increasing that capacity is to create spin-off companies to exploit university discoveries. That is being done with remarkable success in many cases, but more needs to be done.

However, in some markets it may not be practical to create Canadian spin-offs. Some technologies might best be brought to market through multinational enterprises that have Canadian operations. In such cases, negotiations to use IP to create a world product mandate for the Canadian operation would be a good outcome for Canada. At the very least, a significant number of value-added jobs based on the innovation should be created in Canada.

Benefit to Canada can also result if the IP attracts new foreign direct investment (FDI) to Canada. Federal and provincial governments have programs in place to attract FDI, and they should be called on for assistance.

One of the least desirable options is to license IP to a foreign company, with all the jobs and profits realized outside Canada, and to receive only a flow of licence revenue in return – if the licensee, in fact, decides to market the technology.

1. Statistics Canada, Estimates of Canadian Research and Development Expenditures (GERD) Canada, 1987-1998 and by Province 1987-1996. (Service Bulletin. Cat. No. 88-001-XIB, Vol. 22, No. 5. Ottawa, Canada, 1998).
2. Statistics Canada, Estimates of Research and Development Personnel in Canada, 1979-1995. (Science and Technology Working Paper No. ST-97-14, Ottawa, Canada, 1998).
3. Benoît Godin, Yves Gingras and Louis Davignon, Knowledge Flows in Canada as Measured by Bibliometrics (Working Paper prepared for Statistics Canada, Cat. No. 88F0006XPB No. 10, 1998).

The worst option, of course, is to do nothing and lose the potential benefit to Canada entirely.

### **Recommendation #1:**

*The federal government should require an explicit commitment from all recipients of federal research funding that they will obtain the greatest possible benefit to Canada, whenever the results of their federally funded research are used for commercial gain.*

Our second recommendation urges the federal government to develop a coherent IP policy framework. The proposed policy should apply to all university researchers that receive federal research funding, regardless of their position or affiliation. That is to say, the policy should apply to faculty and students alike, including researchers working for universities and their affiliated hospitals, research institutes and Networks of Centres of Excellence (NCEs).

The ownership of IP is an important and controversial issue. Presently there are a number of approaches to determining IP ownership:

- a. in many universities the creator(s) own IP from federally funded research and can commercialize it how they wish, be they faculty, graduate student or post doctoral fellow;
- b. in other cases the creator(s) own the IP but are required to assign it to the university to manage the commercialization process; and
- c. in yet other cases, universities own IP and manage the commercialization process.

Advocates of each approach can point to successes. However, some of the people who have the most experience commercializing the results of research have pointed out lost opportunities and other problems that are caused when creators commercialize research results.

The Panel strongly believes that university ownership of IP (either in the first instance or through assignment) would greatly increase the number of commercialization opportunities emanating from university-based research. The Panel also believes that the benefits arising from these commercialization opportunities must be shared with the creator(s) of the IP. University researchers do not need to own IP in order to benefit from successful commercialization undertakings.

Canadian universities are no strangers to innovation based on research results. Many good practices have been developed and many successes have been achieved. What has been achieved in research-based innovation in Canada, has been done in an environment of laissez-faire by the federal funding agencies, under varied and inconsistent university policies and practices, and under many different organizational arrangements. Rarely has innovation been treated as a mainstream university function, and the importance attached to it varies greatly among the universities. Moreover, university researchers cannot generally be certain that their efforts in innovation will be supported or recognized by the university in the same way as traditional academic work. Our recommendation addresses these problems.

## Recommendation #2:

*In order for researchers to qualify for federal research funding and universities to qualify for commercialization support, universities (and their affiliated research hospitals and research centres) should be required to adopt policies consistent with the principles set out below:*

- 1. Universities (and their affiliated organizations) must recognize the importance of research-based innovation as a mainstream activity by identifying “innovation” as their fourth mission, in addition to teaching, research and community service; alternatively, they might explicitly identify innovation as an element of the three missions, as appropriate.*
- 2. All IP with commercial potential (excluding books and journal articles) that was supported in whole or in part with federal funding, must be promptly disclosed by the researcher to the university. Researchers who do not comply will be denied access to future federal research funding.*
- 3. All IP with commercial potential (excluding books and journal articles) that was supported in whole or in part with federal funding, must be disclosed annually by the university to the federal government, provided that such information is not subject to the Access to Information Act.*
- 4. All IP created from research that was supported in any part by federal funding is owned either by the university or by the researcher(s) who created it. In those universities where the ownership of such IP resides with the researcher(s), the IP must be assigned to the university for possible commercialization (subject to appropriate sharing of benefits – see item 9).*
- 5. Universities (and their affiliated organizations) must make reasonable efforts to commercialize IP that they have found to have innovative potential. They must make reasonable efforts to maximize the benefits to Canada by deploying IP in the interest of generating increased wealth for Canada.*
- 6. Universities can assign IP back to the creator under the following conditions: when the university has decided not to pursue commercialization; when the university has been unsuccessful in commercializing the discovery within a reasonable time frame; or when the university and the IP creator both agree that the creator can maximize benefits to Canada without undue conflict of interest.*
- 7. Universities can assign IP to firms when this is considered necessary to ensure the success of the innovation.*
- 8. Universities can assign IP to NCEs, affiliated research hospitals and affiliated research institutes when the university and the assignee both agree that the assignee can maximize benefits to Canada without undue conflict of interest.*
- 9. Universities (and their affiliated organizations) must provide incentives to encourage their faculty, staff and students engaged in research to create IP. These incentives must include appropriate sharing of net benefits from successful commercial undertakings whether in the form of equity or licensing income. These incentives must also include appropriate recognition of innovative researchers in tenure and promotion policies.*
- 10. Universities (and their affiliated organizations) will encourage the participation of small and medium-sized enterprises and, where appropriate, support the creation of spin-off companies in commercializing publicly funded research. Small businesses, including local spin-off companies, will be given priority to license innovations, dependent on finding appropriate businesses and equitable terms.*
- 11. Universities (and their affiliated organizations) must make reasonable efforts to license or assign innovations locally or nationally. Whenever possible, licensing should be to a Canadian company or a Canadian subsidiary of a foreign company. Commitments to Canadian value-added must be obtained when foreign licensing is the only feasible route.*
- 12. The university must designate a senior officer responsible for innovation arising from its research, and establish an organizational capacity to carry out its innovation function.*

Universities will likely require two years to modify their existing policies, or create appropriate policies in cases where none exist.

The proposed policy framework for managing federally funded IP is a necessary, but not sufficient, condition for success. Additional funding is also required to help universities strengthen their capacity to take advantage of an improved IP management regime.

We recognize that many university researchers are frustrated with the level of support presently available to them by university commercialization offices. If they are expected to assign IP to universities, it is critical that these offices be properly resourced, and staffed with people who are able to manage the innovation process efficiently and effectively. We need to develop world-class commercialization offices that generate high returns to Canada, and in the process generate higher returns to university researchers than they could achieve on their own. The Panel is convinced that once these offices create wealth among researchers, the culture within Canadian universities will change quickly and innovation will become a real priority.

### **Recommendation #3:**

*The federal government should invest new and additional resources to strengthen the commercialization capacity of universities in an amount equal to 5 percent of its investment in university research. This new funding is to be invested in the commercialization function and must be additional to the university's current spending. To be eligible for commercialization grants, universities should be required to adopt policies consistent with federal policy requirements (Recommendation #2), submit annual reports of their innovation performance and submit annually updated innovation strategies to the federal Granting Councils. These reports should reflect the shared priorities and performance of the university and its affiliated research organizations.*

Money alone, however, will not enable university commercialization offices to achieve their full potential. Canada has a skills challenge that must also be addressed. We do not have an adequate pool of people with the skills required to commercialize research. The report offers specific proposals to develop the talent that university commercialization offices require. Part of the solution is to provide opportunities for existing staff to network and share best practices. A national networking forum might also enable universities to more readily identify opportunities for bundling IP.

### **Recommendation #4:**

*With the new funding proposed in Recommendation #3, universities should make the commitment to use their educational resources to develop the people with the necessary entrepreneurial, business and technical skills required to increase the number of successful innovations created from the results of university research. The federal Granting Councils should add to this effort by helping to create national and regional networks to share knowledge, expertise and best practices in this area.*

Successful innovations based on university discoveries or inventions may often require the formation of spin-off companies. This is much more likely when the innovation arises from basic research than when the innovation arises from project research conducted in partnership with an existing company. A spin-off requires new investments at a level far greater than the original public investment in the research. A spin-off also requires the commitment of very skilled people aside from the researchers, most notably entrepreneurs and managers who are experienced in building research-based companies.

It is also important that business conditions support the growth of established companies that form strategic alliances with universities since most technology transfers involve existing companies.

Without supportive business conditions, Canada is very unlikely to reap the benefits of discoveries and inventions arising from university research funded by the public. If any innovations are produced from them, they will probably be produced somewhere else.

### **Recommendation #5:**

*The federal Department of Finance is encouraged to undertake a wholesale review of Canadian tax policy to ensure that it does not impede and, where possible, supports research-based innovation. (Specific proposals are contained in the report.)*

To increase the potential of Canadian universities to contribute to our economy through research-based innovation, the federal and provincial governments should work together to increase the time that university faculty have for research, and to improve the tools with which they work. This involves building further on the measures taken by the Government of Canada in the last three federal budgets to increase research funding. It also requires

a concerted collaboration of the federal and provincial governments to deal with the indirect costs of research and with the basic funding of the universities that is the biggest factor in determining the workload pressures on faculty and staff.

### **Recommendation #6:**

*Governments should increase their investment in university research. They should also resolve, on an urgent basis, situations where universities have difficulties conducting research when federal funding is provided, but when limited provincial support is available for the associated indirect costs.*

None of our proposals, on their own, will position Canada to maximize returns on its investment in research. Taken together, however, we believe that the recommendations contained herein would have a dramatic effect in fuelling the Canadian economy and generating social and economic benefits for years to come.

# 1.0 Universities are Uniquely Poised to Drive Economic Growth and Social Well-being

It is widely understood that productivity growth is the key to economic success in the global knowledge-based economy. Unfortunately, over the last 25 years, Canada has had the lowest rate of productivity growth among G-7 countries. This is not an academic point. Low productivity growth rates in Canada have led to lower standards of living and lower per capita incomes than would otherwise have been the case.

In broad terms, productivity is the ratio of the value of what is produced to the cost of producing it. Productivity can be increased by reducing the denominator (the cost of production), or by increasing the numerator (the value of what is produced). This requires innovation – the introduction of new goods, services or processes that increase the value of what we produce relative to the cost of production. (See Annex 2 for definitions of innovation and other terms contained in this report.)

Innovation is increasingly based on advances in science and technology.<sup>4</sup> The Panel believes that in the global knowledge-based economy, research-based innovation is of critical importance in generating high value-added

economic activity, increased wealth, economic diversification, well-paying jobs, longer and healthier lives, improved environmental conditions, and increased revenues from associated taxes. Research-based innovation is about expanding our ability to create new wealth and improve social conditions, with win-win outcomes for all Canadians.

Despite the importance of innovation, Canada has an innovation gap according to the Organisation for Economic Co-operation and Development (OECD). We do not have a tradition of widespread innovation due, in part, to low levels of investment in research and development (R&D) by the industrial sector. In 1997, R&D investments by the industrial sector in Canada amounted to 1 percent of gross domestic product, and were second lowest among the G-7 countries.<sup>5</sup>

The weak level of investment in R&D by Canadian firms is troublesome. Countries that do not have the capacity to generate new knowledge and exploit its opportunities are dependent on other countries to generate scientific advances that affect their standards of living and competitiveness performance. This is not the path to success as we make the transition to the global knowledge-based economy.

Although not a suitable substitute for industrial R&D, Canadian universities are well placed to strengthen Canada's innovative capacity and productivity performance. They are positioned to play a more prominent role in fuelling national economic growth and social development than universities in most other G-7 countries, including the United States, for two reasons.

**Table 1: Gross Expenditure on R&D in the G-7, by Sector of Performance, 1997**

Country	Industry	Government	Higher Education	Non-profit institutions
(percent, 1997 <sup>†</sup> )				
United States	74.4	8.3	14.3	2.3
Japan	71.1	9.4	14.8	4.5
Germany	68.4	14.3	17.4	0.0
France	61.5	20.4	16.8	1.3
United Kingdom	64.9	14.4	19.5	1.2
Italy	54.5	21.6	23.8	0.0
Canada	64.5	13.2	<b>21.1</b>	1.2

† Estimates for 1997 or latest year available: 1996 for Japan, France and the U.K.  
Source: OECD, *Main Science and Technology Indicators*, 1998

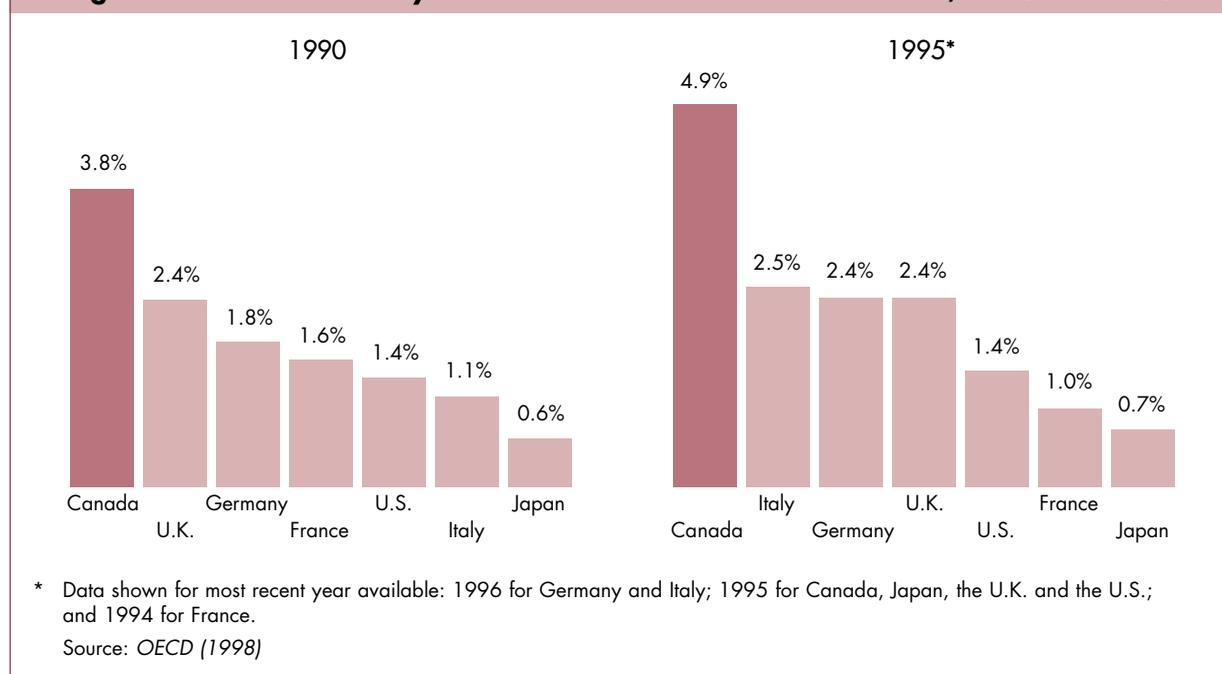
4. Canadian-invented patents have recently been found to be the most highly science linked in comparison to patents from the U.S., U.K., France, Germany and Japan. Peter Kroll and Francis Narin, Linkage Between Canadian Science and Patented Technology (CHI Research Inc. March 29, 1999).

5. W. Gu and Lori Whewell, University Research and the Commercialization of Intellectual Property in Canada: A Statistical Overview prepared for the Expert Panel on the Commercialization of University Research. (Micro-Economic Analysis Directorate, Industry Canada, Ottawa, ON, 1999).

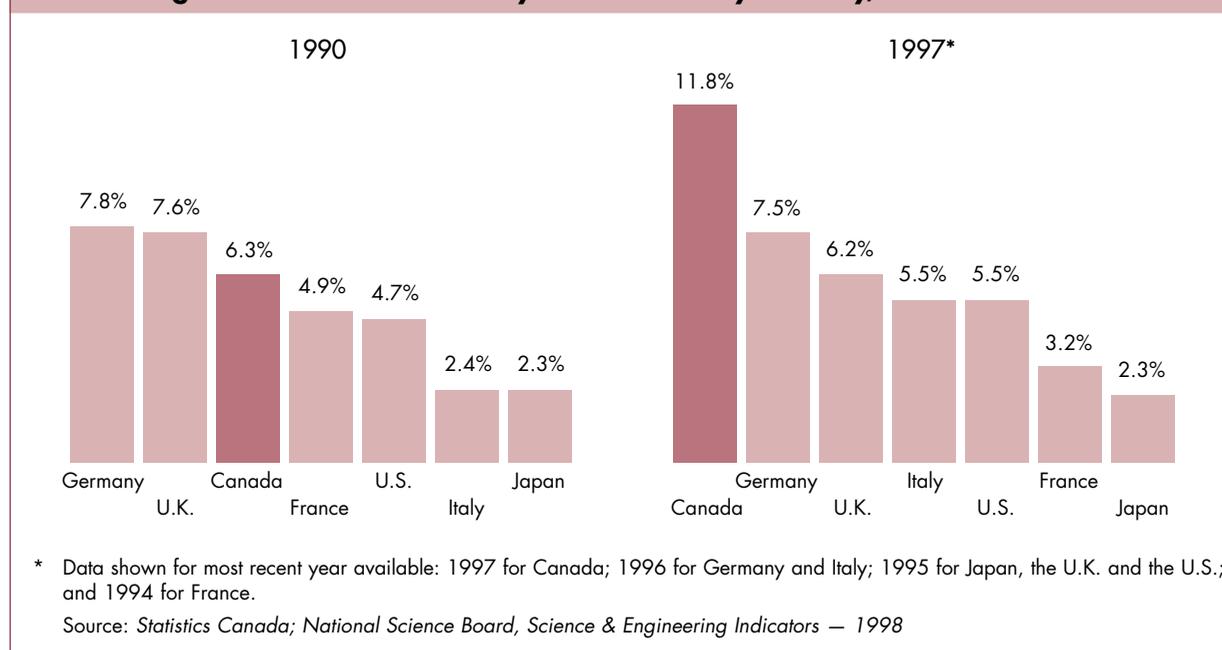
First, Canadian universities perform a larger share of national R&D than in most other G-7 countries, as illustrated in Table 1 on the previous page. (Note that Canadian universities performed 21 percent of national R&D in 1997, financed in part by the industrial sector.)

Second, the industrial sector in Canada depends more on universities as a source of innovation than in any other G-7 country. The industrial sector in Canada out-sourced 5 percent of its overall R&D effort to universities in 1995 (Figure 1), and financed almost 12 percent of all R&D performed by universities in 1997 (Figure 2).

**Figure 1: Share of Industry-Funded R&D Performed in Universities, 1990 and 1995**



**Figure 2: Share of University R&D Funded by Industry, 1990 and 1997**



The Panel recognizes that Canadian universities perform three core functions which make a tremendous contribution to our standard of living and quality of life: research, teaching and community service.

**Research:** Canadian universities perform world-class research. They perform 21 percent<sup>6</sup> of all R&D conducted in Canada, employ 31 percent<sup>7</sup> of Canada's R&D personnel, and produce 65 percent<sup>8</sup> of Canadian scientific publications. University research (be it basic research directed by the principal investigator or project research directed by university researchers with industrial partners) is critical to generating the intellectual foundation for practical innovations. In some cases, university research results in scientific breakthroughs that have immediate practical application. In other cases, research generates new knowledge and insights which generate practical benefits far into the future. Often the greatest benefits are the least expected. The point is that basic and project research are valuable and necessary cornerstones of a healthy economy.

**Teaching:** Canadian universities also contribute directly to the nation's economic performance by graduating highly qualified personnel. Universities perform the critically important role of preparing Canadians to take their place as productive members of society and the labour market. The teaching and research functions are also highly complementary. Scholars who contribute to the current developments in their subject are able to teach it with deeper understanding. Students gain valuable experience working with faculty on research projects and, upon graduation, are perhaps the greatest source of technology and knowledge transfer to the public and private sectors of the economy.

**Community Service:** The third well-established role of Canadian universities is to contribute to the economic and social well-being of surrounding communities. They help their communities understand the nature of the challenges they face and design appropriate responses. The breadth of the community support provided crosses all fields of study and makes a tangible contribution to the strength and diversity of local communities and economies.

Many universities are also actively involved in commercializing the results of their research for a number of reasons. Commercialization can generate returns to the university to support further research. It also generates collateral benefits. For example, as industrial partners become familiar

with the research environment, the age of laboratory equipment, faculty researchers and graduate students, they are more likely to donate equipment to the university, provide additional research support, hire graduate students and engage faculty members as consultants. Faculty members who work with industrial and other private sector partners to commercialize research are more in tune with the needs and challenges of their local communities, and are better positioned to perform meaningful community service. Universities that involve graduate students in industrially relevant undertakings provide educational experiences which better position students to become effective entrepreneurs and productive employees. Faculty who see the practical benefits of their research, and who are fairly rewarded for their contributions, are motivated to make the intellectual contributions required to secure the future prosperity of the nation. And the greater the visible benefits to Canadians from universities' commercialization undertakings, the greater the likelihood of continued public support for the full range of functions performed by universities.

Universities operate as one player in a broader system of innovation. They are increasingly leveraging their resources and expertise by forming strategic alliances with affiliated research hospitals and research institutes, Networks of Centres of Excellence (NCEs), risk capital providers, federal regional agencies, and provincial science and research authorities, to name a few. In this environment, some universities have achieved notable success in commercializing the results of publicly funded research. However, as this report will show, we do not believe that conditions for success are presently in place to enable universities to maximize the returns to Canadian taxpayers.

We have no time to lose in establishing the conditions necessary to enable universities to perform to their full potential in commercializing the results of publicly funded research. Canada's ability to maintain a high standard of living and prosper in the global knowledge-based economy is critically dependent on our ability to find innovative solutions to the medical, environmental, social and economic challenges of the 21st century.

6. Statistics Canada, Estimates of Canadian Research and Development Expenditures (GERD) Canada, 1987-1998 and by Province 1987-1996. (Service Bulletin. Cat. No. 88-001-XIB, Vol. 22, No. 5. Ottawa, Canada, 1998).

7. Statistics Canada, Estimates of Research and Development Personnel in Canada, 1979-1995. (Science and Technology Working Paper No. ST-97-14, Ottawa, Canada, 1998).

8. Benoît Godin, Yves Gingras and Louis Davignon, Knowledge Flows in Canada as Measured by Bibliometrics (Working Paper prepared for Statistics Canada, Cat. No. 88F0006XPB No. 10, 1998).

*“Universities have always played a key role in discovering the new ideas that lead to social and economic progress. But, in the knowledge-based economy we now live in, universities are now literally the idea factories that will shape our future prosperity.” – David Crane*

*The Toronto Star*

*April 4, 1999*

Not surprisingly, other countries have also concluded that they need to be world class at exploiting knowledge in niche areas where they can establish positions of global leadership. To succeed in this competitive environment, Canada must be at the forefront in developing the policies, programs and practices needed to swiftly act on the opportunities which emerge from university research.

The Panel also believes that the time is right because many Canadian universities are receptive. They recognize that expectations are shifting – that governments increasingly expect that public investments in research will contribute to technological innovation, industrial competitiveness and social and economic development. Many have begun to experiment with models to systematically manage the commercialization process. And judging from their response to the Panel, many universities are eager to share their experiences and challenges in order to find ways to strengthen their capacity to develop a world-class commercialization presence.

In keeping with our mandate, this report does not provide an in-depth investigation of the three more traditional roles of universities (research, teaching and community service). **The report instead focusses on how to maximize the returns to Canada from the commercialization of publicly funded research.** While we believe that innovation is critical and warrants greater attention, in no way should this report be interpreted to suggest that universities should pursue innovation at the expense of their other core responsibilities. We need to instead find ways to enable universities to perform each of these complementary roles efficiently and effectively, and still significantly increase their activities in innovation.

The remainder of this report describes the process for commercializing university research (Section 2.0), provides an assessment of how well Canadian universities are performing at the present time (Section 3.0), identifies the barriers to improved performance (Section 4.0), presents a vision for the 21st century (Section 5.0), and presents an action plan to achieve our vision (Section 6.0). This is followed by implementation considerations (Section 7.0), suggestions for measuring progress (Section 8.0), and our conclusions (Section 9.0).

## 2.0 The Innovation Process

It is important to establish a clear understanding of the optimal role of universities in commercializing research results before reaching conclusions on how well they perform in this area, and before offering recommendations to strengthen their performance. Upon review of best practices, the Panel believes that universities require the resources and core competencies to carry out the following functions.

### 2.1 Build Commercialization Infrastructure

Firms, not-for-profit organizations and governments cannot be expected to develop individual relationships with thousands of university researchers to explore opportunities for translating university discoveries into innovations. They require an effective point of entry into universities. Similarly, most university researchers are more interested in pursuing scientific discoveries than personally managing the business and legal issues inherent in commercialization. They generally require substantial support to commercialize the results of their research, and a single point of contact to manage the unfamiliar and complex process.

A handful of Canadian universities began to establish commercialization offices in the mid-1980s, more than a decade after their emergence in the United States. Canada has since witnessed significant growth in the creation of the basic infrastructure required to successfully commercialize research results.

According to Statistics Canada's Survey of Intellectual Property Commercialization in the Higher Education Sector (hereafter referred to as the Statistics Canada survey), 62 percent of universities and degree granting colleges have established central offices or designated senior resources to manage their intellectual property.<sup>9</sup> Since these 50 institutions account for about 98 percent of sponsored research, all research intensive universities in Canada have now established operations to manage intellectual property. These operations are often referred to as Business Development Offices, University-Industry Liaison Offices or Technology Transfer Offices. For the purposes of this report, we will refer to them as commercialization offices.

Canadian universities have experimented with a wide range of organizational models for operating commercialization offices. Some are owned and operated by the university; some are owned by the university but managed by arm's-length corporations whose activities are guided by boards of directors; some models involve a hybrid whereby innovation responsibilities are shared between in-house expertise and outside experts; and some universities collaborate

in designing shared commercialization infrastructures while others establish their own infrastructure. Each model has merit and each university requires the flexibility to endorse the model that best meets its unique circumstances.

### 2.2 Access to Highly Qualified Personnel

To be successful, university commercialization offices require access to, or must be able to recruit and retain, highly qualified personnel. Their staff require an in-depth understanding of the academic, financial and industrial sectors. They should possess an unusual combination of research, business, legal, interpersonal and communication skills.

Not surprisingly, these people are in short supply. Consequently, university commercialization offices need to offer training to their staff to develop the necessary combination of skill requirements. They also need to offer attractive salaries and incentive packages to retain employees actively pursued by firms, venture capitalists, Networks of Centres of Excellence, research hospitals and others in the business of generating innovations from promising research.

### 2.3 Develop Innovation Policies and Strategies

Every university commercialization office should have a mission statement which makes a clear contribution to the overall mission of the university. This needs to be supported by innovation policies governing ownership of intellectual property, conflict of interest and revenue sharing, for example. In addition, commercialization offices should develop annual innovation strategies and evaluate their past performance.

Commercialization offices need to go beyond developing clear and effective mission statements, policies and strategies. They also need to ensure that they are understood and endorsed by university researchers, the industrial and financial sectors, governments and other relevant stakeholders. This requires a capacity to educate and build awareness through such measures as guide books, Web sites, faculty courses and faculty orientation packages.

### 2.4 Facilitate Access to Research Funding

Commercialization offices (or the Offices of Research Services) are generally the liaison between university researchers and sources of research funding. They need to be familiar with the process for securing and administering research grants and contracts from both governments and firms.

9. Michael Bordt and Cathy Read, Survey of Intellectual Property Commercialization in the Higher Education Sector (Statistics Canada Science and Technology Redesign Project, Cat. No. 88F0006XPB No. 01, 1999).

## 2.5 Identify Discoveries with Commercial Application

It is crucial that commercialization offices be world class in their ability to screen and evaluate research-based innovations in order to identify those with commercial potential. This process generally involves reviewing disclosures by researchers of the intellectual property they have created. With over 1000 disclosures in 1997 alone (according to the Statistics Canada survey), this is a large undertaking.

It is not sufficient, however, for commercialization offices to react swiftly and accurately in identifying intellectual property that requires protection and other value-added support to maximize its commercial potential. Commercialization offices also need to walk the floors and help academic researchers recognize when their discoveries or inventions have commercial potential. Without such assistance, opportunities to realize innovations are lost because scientists are understandably less familiar with the needs and opportunities in the marketplace.

University commercialization offices will only be effective at identifying promising university research if their personnel also work proactively with potential investors and firms to understand their needs, and introduce them to research projects at an early stage. This is particularly important in the case of small and medium-sized enterprises (SMEs). They are often less experienced in developing strategic alliances with universities; require more assistance in understanding the opportunities available to them; have traditionally been the primary source of job creation in Canada; and present the best new source of industrial partners for universities because they are a relatively untapped receptor.

## 2.6 Protect Intellectual Property

Commercialization offices require the capacity to quickly develop and implement appropriate intellectual property (IP) management strategies which may involve filing patents, registering trademarks and copyrights, negotiating trade secret agreements, etc. This is a costly undertaking, particularly when patenting is required.

Best practice universities recognize that it is not sufficient to protect their institution's IP in a vacuum. They form networks with other universities and research centres, both domestically and internationally, to identify opportunities for combining IP from different research projects. Creating a portfolio of IP is often required to create higher value-added innovations and to secure the interest of the industrial and financial sectors. Bundling IP is particularly important for Canadian universities, which receive relatively modest funding spread thinly across many institutions.

Moreover, since Canada accounts for only 4.2 percent of the world's scientific publications, the opportunities that come with collaboration are great.<sup>10</sup>

## 2.7 Add Value to Intellectual Property

Once promising discoveries are identified and adequately protected, university commercialization offices sometimes need to enhance their value in order to attract financial or industrial partners – the players who can successfully take the innovation to the marketplace. This phase generally involves developing scientific development plans, conducting market or feasibility studies, and developing business plans. Best practice universities form strategic alliances with private sector partners when carrying out these functions, in order to benefit from their expertise, knowledge of the market and specialized resources.

University commercialization offices also require financial resources to demonstrate the validity of their scientific concepts through the development of prototypes. Working prototypes help universities attract licensees, investment capital and spin-off management. However, best practice universities recognize that if investors do not see sufficient market potential in a university discovery to warrant prototype development, they should be very cautious about spending scarce resources in this area. The Panel believes that universities require the capacity to invest modestly in prototype development, ideally in a co-investment capacity.

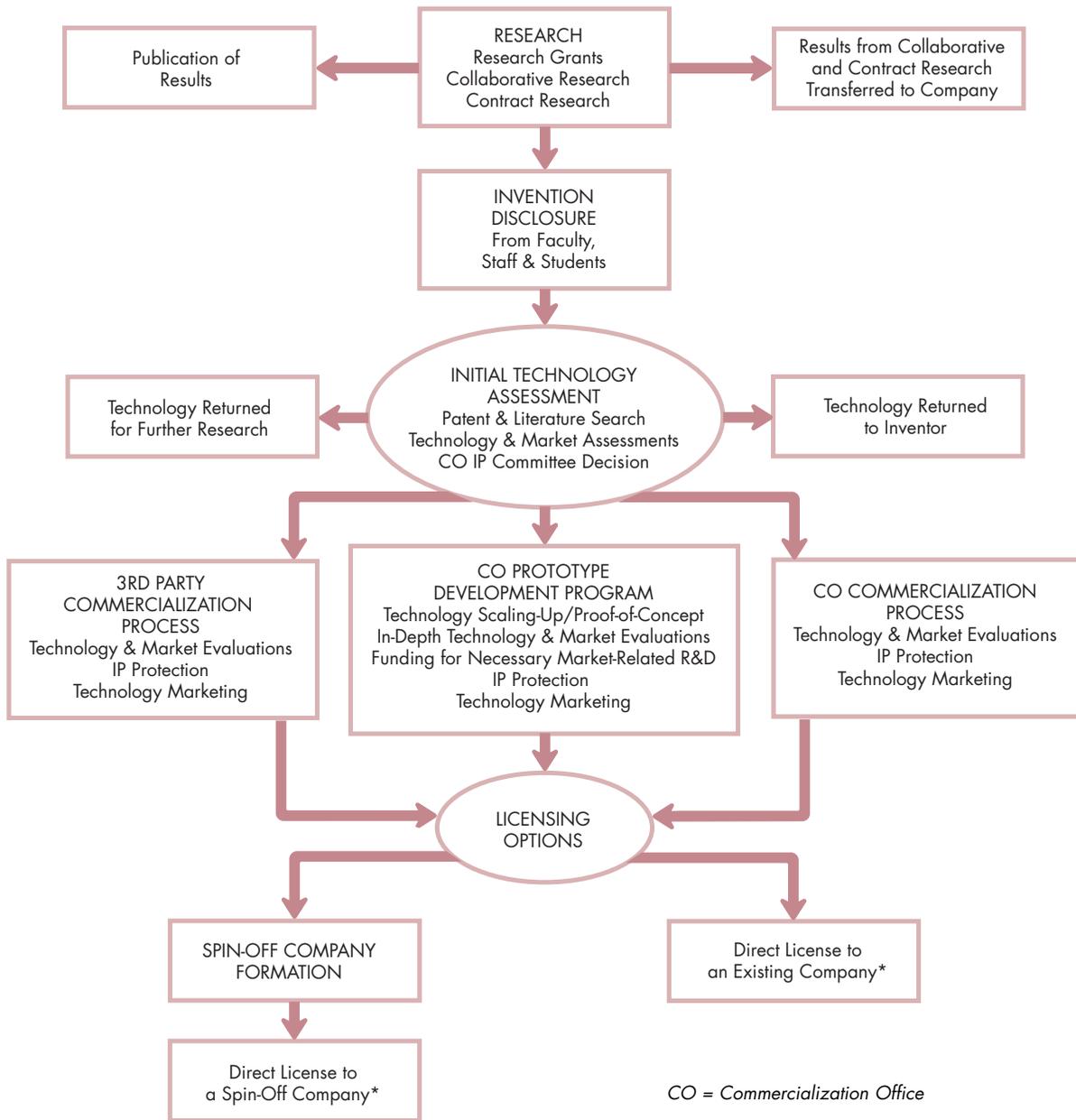
## 2.8 Commercialize the Most Promising Discoveries

Innovation arising from project research is generally an explicit objective of the work, and it usually takes place through technology transfers to partnering businesses. Innovation from basic research depends much more on bringing new products to market through new channels. This may include creating spin-off companies or negotiating licensing agreements with established firms. Each of these commercialization pathways has merit, and commercialization offices require the flexibility to select the “right” pathway on a case by case basis.

Many commercialization offices are familiar with the process for negotiating technology transfer agreements with firms involved in project research, and negotiating licencing agreements with established firms and newly created spin-off companies. The most contentious issues generally revolve around how to value the relative contributions of universities and firms, and how to arrive at a fair distribution of anticipated returns. Annex 3 sets out a number of considerations to guide universities in this area.

10. Benoît Godin, Yves Gingras and Louis Davignon, Knowledge Flows in Canada as Measured by Bibliometrics (Working Paper prepared for Statistics Canada, Cat. No. 88F0006XPB No. 10, 1998).

## Commercialization Pathways



CO = Commercialization Office

\* May lead to the assignment of IP to the company in exchange for equity, once agreed-upon corporate milestones are achieved.  
Source: Adapted from University-Industry Liaison Office Technology Transfer Process at University of British Columbia, Livingstone (1998)

There is greater uncertainty concerning the role of university commercialization offices in creating spin-off companies. The Panel believes that commercialization offices should be integrally involved in creating companies and other legal structures required to host their discoveries, selecting professional management teams, and securing the necessary working capital. However, performing these activities requires an infrastructure that is too costly for any individual office to establish, and requires expertise beyond that available in universities. At this point, economies of scale are required to generate acceptable returns. Leadership for these functions should rest with investors who have the necessary infrastructure and networks to provide adequate support, expertise and value.

## 2.9 Maximize the Value of the Public Investment in Research

The success of a university commercialization office should not be measured by the number of licences it negotiates or the number of spin-off firms it creates. Commercialization offices should instead endeavour to maximize the value of the companies which license their innovations and maximize the value of the companies they create. If they are successful in maximizing their clients' value, universities will maximize the economic and social returns to Canada as well as to themselves.

In the post-commercialization phase, universities require the capacity to manage equity portfolios over an extended period. Best practice universities form strategic alliances with the industrial and financial sectors to offer their combined expertise to nurture emerging firms at their most vulnerable stage. They provide frequent and confidential advice to each spin-off company. Some universities also establish research parks and business incubators, although this strategy has seen mixed results to date. Yet others make follow-on investments in the companies in which they own equity in order to protect their competitive positions. This sends a strong signal to researchers that their efforts will be backed up.

Canada cannot afford to fail on this front because lacklustre performance by corporate licensees and spin-off companies will create a downward spiral of benefits arising from university research. Success breeds success. If firms licensing technologies from universities improve their competitiveness standing, they will continue to seek out innovations from Canadian universities and fund university research. If investors providing seed capital to emerging spin-off companies obtain a healthy return on their investments, they will continue to support the establishment and growth of new companies. If universities and their researchers obtain a fair share of the overall wealth they help create, they will have a vested interest in launching additional commercial undertakings. And, if the public witnesses the creation of well-paying jobs and improved social conditions as a result of university research, it will support ongoing public investments in this area.

## 3.0 Assessment of Universities' Innovation Performance

Many universities in Canada have achieved notable successes in commercializing research results. As the following highlights show, the academic and industrial sectors in Canada have established an unparalleled level of R&D alliances among the G-7. In addition, Canadian universities are generating invention disclosures, income generating licences and spin-off companies at an impressive

### Canadian Universities' Commercialization Performance<sup>11</sup>

*In 1997, the industrial sector funded almost 12 percent of all R&D performed by Canadian universities, up from 6 percent in 1990.<sup>12</sup> No other G-7 country comes close to matching this level of industry-academic strategic alliance.*

*For the 14 Canadian universities which responded to the Association of University Technology Managers, Inc. (AUTM) 1997 survey, invention disclosures have grown by 176 percent since 1991, far outpacing their American counterparts' 85 percent growth rate.*

*In 1997, 14 Canadian universities reported a 280 percent rate of growth in their number of income generating licences and options to AUTM, compared to a growth rate of 156 percent for American universities.*

*In 1997, Canadian universities generated \$15.6 million in royalties.*

*In 1997, Canadian universities held over \$22.5 million in equity in 366 spin-off companies. The number of spin-off companies created by Canadian universities reporting to AUTM doubled over the 1994-1997 period, compared to a 50 percent increase for American universities.*

*In 1998, published reports declared a Canadian university as the leading North American university in creating spin-off companies per \$10 million of research, outranking such famous centres as MIT and Stanford. The remaining Canadian universities which report to AUTM were also ranked favourably.*

rate of growth. We also believe that certain fields of research are performing better than others, with medical research in particular generating impressive commercialization outcomes.

These statistics do not, however, provide conclusive insights on how well Canadian universities are performing in generating innovations from research results.

- First, it is not surprising or impressive to witness higher rates of growth in Canada. We are a much smaller country and about a decade behind the United States in experimenting with commercialization undertakings. High rates of growth from a small base of activity does not constitute evidence that innovation generated from university research in Canada is on par with the United States – the world leader against which we will benchmark Canadian universities. The growth rates generally cited (including those above) also overstate progress in both Canada and the United States due to rising numbers of survey respondents over the years.
- Second, many of the above-noted indicators are “input” measures, rather than measures of our effectiveness in generating commercial outcomes. The level of strategic partnering between universities and firms, for example, provides a better measure of our potential to generate commercial benefits than our actual performance.
- Third, success should not be measured by the number of licences negotiated or the number of spin-off firms created, but rather by the economic and social benefits generated by these activities.
- Fourth, returns to the university (e.g. royalties and equity) are not meaningful measures of the true rate of return to the country from investments in research. Universities capture only a small portion of the total benefits to the economy.
- Finally, published reports ranking Canadian universities among the top North American performers in generating spin-off companies per \$10 million in research suffer from a serious methodological error. In comparing spin-off track records relative to investments in research, these reports did not take into account that American respondents report total research expenditures while Canadian universities report only direct research costs. The resulting comparison of commercialization outcomes, as a proportion of the research investment, grossly overstates the performance of Canadian universities.

11. Unless otherwise noted, references to Canadian universities rely on data obtained from Statistics Canada's 1998 Survey of Intellectual Property Commercialization in the Higher Education Sector and AUTM's 1991-1997 Licensing Surveys. The Statistics Canada survey provides valuable information about 81 Canadian universities' commercialization policies, practices, and outcomes. All universities performing significant amounts of research are captured. AUTM provides institution-specific information for 132 U.S. and 14 Canadian universities.

12. Statistics Canada; National Science Board, *Science & Engineering Indicators — 1998*.

The Panel believes that the best way to measure Canada's commercialization performance is to examine rates of return on investment. The ideal benchmark would be return on investment measures for American universities which are considered to be world leaders in this area. Unfortunately, few studies broach this issue, and those that exist are beset with measurement and conceptual problems.

Clearly, better data are required to develop a clear and undisputed baseline and to measure performance over time.

**We urge the Social Sciences and Humanities Research Council of Canada to encourage and support additional research in this area. In addition, we urge Statistics Canada to consider implementing the recommendations contained in Annex 4.**

In the absence of ideal measures, we assess how well Canadian universities are performing by comparing available information on their activities, against our assessment in Section 2.0 of what these offices should be doing. The following points suggest that universities are not yet positioned to maximize the returns from the public investment in research.

- According to the Statistics Canada survey, the operational budget for IP management at Canadian universities totalled \$12.6 million in 1997/98. With the value of sponsored research approaching \$2 billion, this means that only 0.7 percent of the value of sponsored research is available to fund the operations of university commercialization offices.
- Canadian university commercialization offices collectively employ 186 people (full time equivalents).<sup>13</sup> This translates into less than one person for every \$10 million in sponsored research conducted. One-half of these people are likely providing administrative support, leaving few bodies to undertake core innovation functions.
- Anecdotal evidence suggests that training, which is critical to developing the skills required to operate an effective commercialization office, is often not an option given budgetary constraints and the time pressures faced by the limited number of staff.
- Most Canadian university commercialization offices do not appear to have clear mandates that are perceived as integral to the mission of their universities.
- Some Canadian universities have yet to develop innovation policies, and the policies that do exist are often not sufficiently transparent to attract industrial and financial partners.
- Few Canadian university commercialization offices develop strategies or evaluate their performance on a regular basis.
- Commercialization offices are not as proactive as they should be in identifying discoveries with innovation potential. In the majority of cases, it is up to university researchers to determine whether their discoveries have commercial potential and initiate discussions with commercialization offices. According to the Statistics Canada survey, only one Canadian university strictly monitors the activities of researchers.
- Anecdotal evidence suggests that many universities are not effective in reaching out to the industrial and financial communities.
- There would also appear to be considerable scope for universities to increase their IP protection activity. As mentioned earlier, Canadian universities perform 21 percent<sup>14</sup> of the nation's R&D, employ 31 percent<sup>15</sup> of Canada's R&D personnel and author 65 percent<sup>16</sup> of Canadian scientific publications. Yet, they account for only 4.4 percent of Canadian inventions patented in the United States.<sup>17</sup> Statistics Canada's survey further reveals that only a minority of Canadian universities were engaged in the full range of possible protection activities in 1997, as shown in Table 2.
- Many of those consulted noted that university commercialization offices often do not conduct market assessment, prototype development and other value-added functions. They claim that opportunities to develop quality science are lost due to resource constraints. Statistics Canada's survey would appear to confirm this view. On average, less than \$68 000 is available to commercialization offices per staff employed. This is barely sufficient to cover salaries, let alone value-added functions.

13. Michael Bordt and Cathy Read, Survey of Intellectual Property Commercialization in the Higher Education Sector (Statistics Canada Science and Technology Redesign Project, Cat. No. 88F0006XPB No. 01, 1999).

14. Statistics Canada, Estimates of Canadian Research and Development Expenditures (GERD) Canada, 1987-1998 and by Province 1987-1996. (Service Bulletin. Cat. No. 88-001-XIB, Vol. 22, No. 5. Ottawa, Canada, 1998).

15. Statistics Canada, Estimates of Research and Development Personnel in Canada, 1979-1995. (Science and Technology Working Paper No. ST-97-14, Ottawa, Canada, 1998).

16. Benoît Godin, Yves Gingras and Louis Davignon, Knowledge Flows in Canada as Measured by Bibliometrics (Working Paper prepared for Statistics Canada, Cat. No. 88F0006XPB No. 10, 1998).

17. Benoît Godin, special tabulation. Cited in Michael Bordt and Cathy Read, Survey of Intellectual Property Commercialization in the Higher Education Sector (Statistics Canada Science and Technology Redesign Project, Cat. No. 88F0006XPB No. 01, 1999).

**Table 2: University Intellectual Property Protection Activity**

IP Type	Applicable Protection Activity	Universities Engaged in Protection Activities	
		#	%
Inventions	patent application	30	37
Computer software or databases	copyright registration	4	5
Literary, artistic, dramatic or musical works, books, papers	copyright registration	5	6
Educational materials	copyright registration	3	4
Industrial designs	registration	2	2
Trademarks	registration	14	17
New plant varieties	registration (Cdn); patent (US)	2	2
Various	trade secret agreement	4	5

Source: Statistics Canada Survey of Intellectual Property Commercialization in the Higher Education Sector, 1998

- While many university commercialization offices have established networks, they tend to be regional or available to only the largest universities. Moreover, existing networks provide a limited forum for sharing information on commercialization challenges and best practices. Commercialization offices do not yet have the capacity to network effectively in order to identify and act on opportunities to bundle IP, in a domestic and international context.

***The Panel is convinced that Canadian universities, recognizing all their achievements and outstanding challenges, have tremendous unrealized potential to strengthen Canada's economy.***

To illustrate this potential, we refer the reader to a recent study by the Association of University Technology Managers Inc. (AUTM). In 1997, AUTM concluded that American and Canadian universities together generated US\$28.7 billion in total benefits to the economy, supporting an estimated 245 930 jobs. Consistent with their methodology, we calculate that Canada's share amounted to US\$0.5 billion in economic benefits and 3935 jobs. (This is not an estimate of Canadian universities' total economic impact. It is an estimate of the economic impact of the 14 Canadian universities which report to AUTM, and which account for 50 percent of Canadian university R&D expenditures.<sup>18</sup>)

Had these Canadian universities generated economic returns at a level commensurate with their share of the research investment, they would have contributed almost US\$1.5 billion more in economic benefits and created 12 788 more jobs in 1997. (See Annex 5 for the methodology employed to arrive at these findings.)

While this is a rough and albeit imperfect measure of Canada's unmet potential, the point is that Canadian universities are not maximizing returns from the public investment in research. Under the right conditions, however, we have every reason to believe that they can develop a world-class commercialization presence and generate very substantial incremental gains to Canada.

18. In 1997, the AUTM survey reported on 14 Canadian universities, 2 Canadian research institutes and 132 American universities, accounting for 50 percent and 67.5 percent respectively of all R&D expenditures in the Canadian and U.S. higher education sectors. The body of our report does not refer to Canadian research institutes as they accounted for only 1.5 percent of Canadian total sponsored research expenditures and 0.2 percent of Canadian gross licensing income.

## 4.0 Barriers Preventing Canadian Universities from Achieving Their Full Potential

There are a number of reasons which explain Canadian universities' weak commercialization performance relative to the United States'. Perhaps first and foremost, Canadian universities only began to experiment with commercialization undertakings in the last decade, while the Americans have been active for a considerably longer period of time. MIT, for example, established its commercialization infrastructure in 1940. The time factor is relevant because returns from the commercialization of research can take seven to ten years to generate, depending on the field of research.

Time and patience, however, are not the answer. A number of structural barriers need to be addressed to put Canadian universities on a higher growth path in generating commercial outcomes from investments in research. If Canada does not take steps to address these barriers, we will only achieve incremental gains over time, and cannot hope to reach our full potential.

This section elaborates on four key barriers: the absence of a coherent university IP policy framework; underdeveloped commercialization capacity in Canadian universities; business conditions which limit the success of firms which rely on universities as a source of innovation; and low levels of investment in university research. (Section 6.0 presents recommendations to address these barriers.)

### 4.1 Absence of a Coherent University Intellectual Property Policy

The three federal Granting Councils are expected to invest \$940 million in university research in 1999/2000. These funds are allocated on the basis of scientific peer reviews and advice from business expert panels, which together establish the quality and potential of the research. The Granting Councils do not require full disclosure by researchers of any IP generated from federally funded research grants, and they do not claim ownership of any resulting IP.

In the absence of a Canadian federal policy on ownership and disclosure, a wide variety of practices has emerged. Some universities have established policies which specify whether the university or its researchers own IP, and whether the disclosure of IP created by researchers is required. Other universities have elected not to establish explicit policies. In these circumstances, IP ownership rights belong to the creators (whether faculty, graduate student or post-doctoral fellow), and they are not required to disclose IP to their university.

A recent survey by Ketis<sup>19</sup> of 19 Canadian universities revealed that about one-half confer IP ownership on the creator, and one-half require that ownership be assigned by the creator to the university. Statistics Canada's survey provides dramatic evidence of both the diversity and complexity of approaches governing IP ownership and disclosure at Canadian universities, as shown in Tables 3 and 4.

**Table 3: Intellectual Property Ownership Policies**

Type of intellectual property	Institution owns both IP and all royalties	Researcher owns both IP and all royalties	Research contract sponsor owns both IP and all royalties	Shared ownership and/or shared royalties	IP type not applicable	Total
# of Universities						
Inventions	10	28	0	35	8	81
Software or databases	8	40	0	33	0	81
Literary, artistic works, etc.	1	70	0	10	0	81
Educational materials	5	60	0	16	0	81
Industrial designs	7	45	0	17	12	81
Trademarks	11	40	1	17	12	81
Integrated circuit topographies	8	46	0	15	12	81
New plant varieties	10	42	0	11	18	81

Source: Statistics Canada Survey of Intellectual Property Commercialization in the Higher Education Sector, 1998

19. N.V. Ketis, J. Rudolph and M. Gravelle, "Ownership of Intellectual Property in Canadian Universities," AUTM Newsletter (1998).

**Table 4: Reporting Requirements**

Type of Intellectual property	Researcher always required to report	Researcher sometimes required to report	Researcher never required to report	IP type not applicable	Total
	# of Universities				
Inventions	26	18	29	8	81
Software or databases	12	29	40	0	81
Literary, artistic works, etc.	10	16	55	0	81
Educational materials	8	21	52	0	81
Industrial designs	13	11	45	12	81
Trademarks	12	10	47	12	81
Integrated circuit topographies	12	12	45	12	81
New plant varieties	13	12	38	18	81

Source: Statistics Canada Survey of Intellectual Property Commercialization in the Higher Education Sector, 1998

The absence of a coherent national policy on IP ownership and disclosure in Canada is resulting in the immediate loss of commercialization opportunities, leaked benefits to other countries, costly litigation, and is limiting the longer-term innovative potential of Canadian firms.

#### 4.1.1 Lost Commercialization Opportunities

The Panel believes that vesting IP ownership with university researchers is one of the single biggest factors accounting for lost commercialization opportunities in Canada. Since most university discoveries involve multiple researchers, this approach has resulted in much co-ownership of IP in Canada. This is making it very difficult to negotiate licensing agreements with established firms. Under a co-ownership model, it is equally difficult to entice risk capital providers and skilled managers to support the establishment of spin-off companies.

Co-owners of patents cannot grant exploitation licensing rights without the agreement of the other co-owners. **In the event of a conflict, licensing is paralysed.** This approach has made it difficult, if not impossible, to interest a manufacturer in the technology unless all co-owners agree to grant an exclusive licence. In contrast, in the United States any co-owner of a patent may grant non-exclusive exploitation licences without the consent of the other co-owners.

Co-ownership also introduces an element of uncertainty and risk that is enough to dissuade many in the private sector from participating in technology transfers from Canadian universities. Before private sector partners invest considerable amounts to bring a discovery to the marketplace, they require certainty over who has title to the discovery for which they will be negotiating exploitation rights.

Under the present arrangement, **they are reluctant to negotiate with the owner or co-owners before them because they cannot be sure that additional researchers will not come out of the woodwork at a later date claiming that they contributed to the discovery, and challenging the terms of the deal that was struck.** Challenges may arise, for example, if a researcher is excluded from revenue sharing arrangements, does not agree that the discovery should be used for the purposes intended, believes that another company could more successfully commercialize the discovery, etc. During our consultations, some of the most experienced technology transfer practitioners in Canada described lucrative deals that simply did not proceed due to policies which vested IP ownership with university researchers.

Immediate benefits to Canada are also lost when researchers with IP ownership entitlement are simply not interested in exploring commercial opportunities. Indeed, most researchers are far more interested in pursuing science-based discoveries than using their scarcest of commodities – time – to write business plans, draft legal technology transfer agreements and the like. Since researchers are often not required to disclose their IP to universities, it is impossible to know how many good opportunities are presently being lost.

#### 4.1.2 Leaked Benefits

While many of the university researchers that do commercialize their IP generate benefits to the nation, it is not reasonable to assume that they all act in the national interest. The Panel is aware of many cases where Canadian researchers created IP with public funds, entered into consulting contracts with U.S. firms, and were handsomely

rewarded through consulting fees in return for assigning away IP rights. This is how Canada lost the jobs and investments that it was entitled to expect from its investment in therapeutics research. Although most of the research was funded by Canada, all manufacturing and value added from this global industry is taking place outside the country.

In yet another case, a respiratory medical device was developed at a Canadian university by a post doctoral fellow. The fellow subsequently left Canada for Israel, taking with him the concept and design of the device. It is now the basis of a very successful company in Israel, and is in use in hospitals throughout Europe and the Middle East.

Again, without full disclosure requirements, it is impossible to put a figure on the magnitude of these losses. In an attempt to shed some light on the severity of the leakage of national benefits, the Panel informally canvassed the views of select university researchers. Their responses provide further qualitative evidence that faculty ownership of publicly funded IP is creating a disturbing situation in Canada. These are the individuals on the front line, and what they see is Canada running a technology supply house for other countries.

People living in the United States also recognize that the absence of a coherent national IP policy is resulting in lost commercial benefits. During our consultations, a patent lawyer in California remarked on the excellence of Canada's research, and noted that it is a "pity" that policies cannot be put in place to generate greater benefits for Canadians.

#### **4.1.3 Litigation**

Vesting IP ownership with researchers not only leads to missed opportunities and leaked benefits, it also creates a potential legal quagmire that is invariably expensive and time consuming to unravel. Universities can expect to face higher levels of litigation when individual researchers, more experienced in science than business, commercialize their own research results. Cases are already emerging where universities are being sued due to the actions of faculty researchers (e.g. negotiating royalty payments without due consideration of graduate student contributions, negotiating exclusive licences with multiple firms, etc.).

The greater the number of individuals commercializing research without professional qualifications and experience, the greater the risk of litigation. This problem will become more acute as our research activity scales up in response to the recent federal commitment to increase research funding and establish the Canadian Institutes for Health Research.

#### **4.1.4 Limiting Innovative Capacity of Canadian Firms**

The complex web of IP ownership policies in Canada also discourages industry-academic collaboration by creating a disincentive to the formation of R&D consortiums. This,

ironically, comes at a time when both federal and provincial governments are encouraging industry-academic partnerships through collaborative research grants and support for Networks of Centres of Excellence (NCEs).

Multi-institutional partnerships are recognized as an effective way to generate higher value research and facilitate the transfer of innovations to the private sector. Yet the wide array of IP ownership policies poses a serious barrier to creating R&D consortiums. All parties wishing to collaborate must first negotiate IP ownership rights. This is a time consuming and frustrating exercise when multiple universities with inconsistent policies are involved. Some NCEs, for example, have spent more than a full year negotiating IP ownership rights before engaging in collaborative research. In yet another case, we were told that a university had to cancel its research project. By the time they concluded negotiating IP ownership rights, the research was rendered obsolete in the fast moving information technology field.

The diverse range of IP ownership policies also invites firms to play universities and researchers off each other in order to negotiate most favourable IP rights. This has the potential to create lasting ill feelings and mistrust between the academic and industrial communities, again countering government efforts to encourage collaboration in order to generate win-win outcomes.

#### **4.1.5 Conclusions**

The most troubling aspect of the above-noted case studies is that the researchers did nothing wrong. The federal government provided them with public funds to pursue research, they owned the resulting IP, and they were under no obligation to maximize benefits to Canada. Canada should not continue to forgo good opportunities to generate jobs and social benefits for Canadians. Neither should we stand by while foreign firms strengthen their competitive standing and create good jobs outside the country as a result of owning IP paid for and created by Canadians.

Unfortunately, hard data on the magnitude of the losses is not available because far too often researchers are not required to fully disclose innovations with commercial potential to their universities. As a result, universities and governments do not know the full range of IP with commercial potential, cannot identify and resolve conflicts of interest, and cannot measure the extent to which benefits are captured in Canada. This situation must be rectified.

The commercialization of university research is an industry still in its infancy stage in Canada. To date, lost benefits are perhaps tolerable given the small base of total activity. However, as universities scale up their commercialization activities, lost benefits will become a more apparent drag on Canada's productivity performance and Canadians' standard of living.

The Panel believes that the federal government's *laissez-faire* approach with respect to disclosure requirements and IP ownership is not adequate. In the knowledge-based economy, where economic and social advantage is increasingly a function of our ability to translate scientific discoveries into market opportunities, we cannot afford the present haphazard and unprofessional approach to managing our investment in knowledge.

## 4.2 Underdeveloped University Commercialization Capacity

The second barrier to achieving our full potential is centred on the need to strengthen Canadian universities' commercialization capacity. As noted earlier, Canadian university commercialization offices are under-resourced. At their present level of funding, they cannot offer competitive market salaries to attract qualified personnel, hire personnel in sufficient numbers to establish effective operations, provide adequate training to staff, protect the full range of promising IP, and provide the value-added required to maximize returns to taxpayers.

Few sources of funds are available to commercialization offices. The Natural Sciences and Engineering Research Council of Canada (NSERC) provides \$3 million annually to university commercialization offices through its Intellectual Property Management Program. The program supports a research investment of almost \$500 million. Investing 0.6 percent of the research base in commercialization does not begin to meet the costs of the functions described earlier, and has served to fund only a few successful but small experiments. Some provinces (British Columbia, Alberta and Manitoba) provide limited additional assistance on a project-by-project basis. Most recently, Quebec announced a special fund to assist universities in this area.

Money alone, however, will not solve the problem. The underperformance of commercialization offices is also attributable to a tight labour market. There are simply too few people with the skills required. Additional financial resources would help universities attract highly skilled personnel and upgrade skills through training. However, other measures are also required to develop the talent required by universities, research hospitals, firms, venture capitalists, NCEs and others in the business of commercializing promising research.

Of all the issues raised by stakeholders we consulted, the greatest consensus emerged around the need for universities to develop their commercialization capacity. Private sector groups were as adamant as universities that this issue needs to be addressed before we can hope to improve the capacity of all parties to effectively work together to achieve maximum commercial benefits.

## 4.3 Uncompetitive Business Conditions

Canadian universities' weak commercialization performance is not only attributable to the absence of a coherent IP policy framework and limited university commercialization capacity. Uncompetitive business conditions are also limiting our ability to generate returns from public investments in research.

To maximize the benefits from investments in research, we need to maximize the success of the firms which form strategic alliances with universities, be they established firms licensing university innovations or newly created spin-off companies. Their success in translating university discoveries into market opportunities is the key to maximizing the return on the public investment in research.

The Panel believes that firms entering into strategic alliances with universities are not as successful as they potentially could be, and that governments need to take action to establish a business environment more conducive to their growth.

Access to skilled personnel and to highly qualified managers is among the most critical factors affecting the success of firms. Anecdotal evidence suggests that these people are in short supply, and firms are experiencing difficulty attracting and retaining the talent they need to compete in the global knowledge-based economy. The Panel believes that aspects of Canada's education system and tax policy are contributing to this problem.

The skills issue is complex. It brings into play multiple jurisdictions and is affected by a wide array of policy instruments. While the skills issue is relevant to the work of the Panel, its impact on Canada's economic performance and the social well-being of Canadians is of much broader scope. Consequently, the Prime Minister's Advisory Council on Science and Technology established an Expert Panel to study Canada's skills requirements, independent of this body of work. So as not to duplicate effort, we will limit our assessment of the skills challenge to the elements of Canada's tax policy that unduly constrain the growth of high-tech firms – those most dependent on universities as a source of innovation.

The Panel believes that high levels of personal tax, employee share ownership tax treatment, capital gains tax treatment and RRSP investment restrictions are putting Canadian firms at a competitive disadvantage relative to their American counterparts. These policies are discouraging the formation of spin-off companies, and limiting the growth potential of spin-offs and established firms entering into strategic alliances with universities. (See Annex 6 for a more in-depth discussion of tax barriers and recommendations.)

### 4.3.1 Personal Taxation

Canadian companies seeking to recruit highly skilled managers and employees from Canada and abroad are facing difficulties matching after-tax salaries offered in the United States. This is primarily due to higher rates of personal taxation in Canada and the deductibility of mortgage interest in the United States.

The problem is not limited to constraining Canadian firms' growth prospects. It is sufficiently acute that we are now witnessing lost investment opportunities in Canada and the leakage of benefits from our investment in university research to other countries.

We are aware, for example, of a Vancouver biotechnology company whose technology originated from research performed at the University of British Columbia. The firm decided to move its operations to San Diego due to high personal tax rates in Canada. The firm in question was not successful in recruiting personnel from the United States, and could not compete for highly skilled Canadians whose alternative was to relocate south of the border. The Chief Executive Officer believes that many other companies are considering the same solution, and noted that for political reasons these moves are kept low profile.

### 4.3.2 Tax Treatment of Employee Share Options

Employee share options are a powerful tool to encourage the formation and ongoing competitiveness of firms. They are commonly employed in the technology industry to attract and retain skilled employees, provide employees with an incentive to strengthen the economic value of their firms, and enable management to participate in the growth of the value of their company's equity alongside investors.

Under the present tax regime, Canadians are taxed on the difference between the value of a share when purchased from their company and the cost of buying it. If the company is not a Canadian Controlled Private Corporation (CCPC), the employee must pay such tax in the year when the shares are bought, whether or not the shares are sold. This has the harmful effect of requiring the payment of income tax when there might be no cash to pay the tax, and can lead to the sale of shares to pay the tax. These differences in value over cost are treated as income; employees of non-CCPC firms may end up paying full income tax rates compared to only 75 percent of such rates for employees of CCPCs. These gains are not eligible for capital gains treatment. Furthermore, since the status of the company is not an issue when the employees' shares are sold, shares purchased the day before a company goes public (i.e. when it is still a CCPC) give CCPC employees a large benefit not available to employees of public companies.

These rules limit the incentive available to employees to strengthen the competitiveness of the firms that employ them, be they established firms or newly created spin-offs.

These limitations apply equally to investors, including universities and their researchers. The effect is to discourage investors from taking equity in firms – a route this report supports to maximize firm value and the returns on investments in research.

### 4.3.3 RRSP Investment Restrictions

A "designated shareholder" is defined as a person (or relative of a person) who owns 10 percent or more of the issued shares of any class of the capital stock of a corporation. At the present time, the capital stock of a corporation in which the owner of an RRSP is a designated shareholder cannot be held in that person's RRSP. This has the effect of restricting the flow of "love money" into newly formed business ventures which often require an initial injection of capital from inventors and their relatives.

## 4.4 Low Levels of Investment in University Research

The final barrier limiting Canadian universities' ability to innovate, relates to our level of investment in university research and our approach to funding the indirect cost of research.

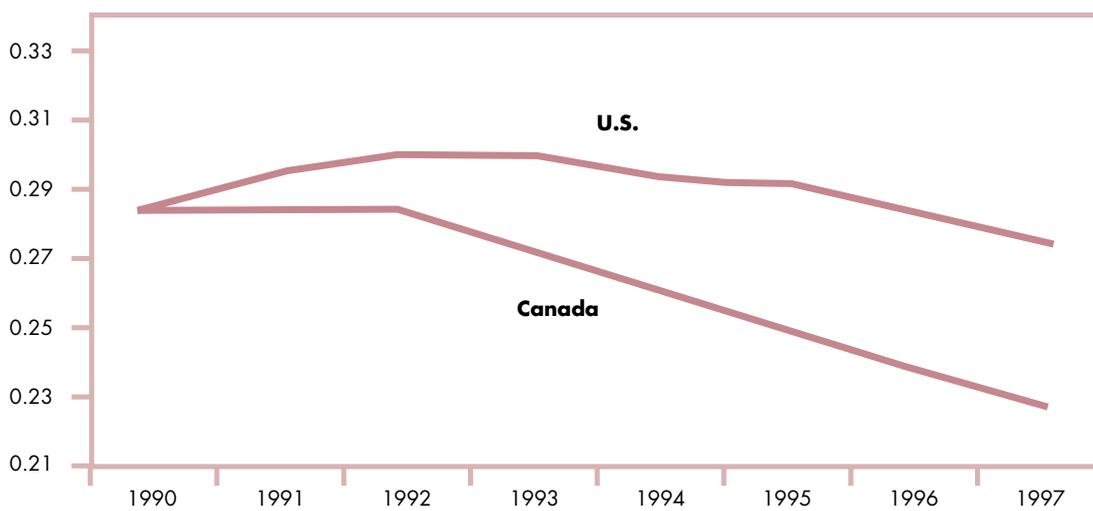
### 4.4.1 Federal Support for University Research

In recent years, a number of new seed funds have been established in Canada with over \$200 million available for investment in promising technologies (see Annex 7). At issue is whether there is a sufficient number of quality deals emanating from universities and elsewhere to entice seed funds to carry out their investment intentions.

The lack of investment grade opportunities is a major stumbling block. The quality of Canadian science is not being questioned. The problem is that good opportunities emanating from existing university research are likely being missed and Canada's investment in university research is too modest. With some coherence around university IP policies and adequately resourced commercialization offices, universities should be able to identify and present the full range of attractive investment opportunities to investors.

This will not, however, be sufficient. If there is to be more commercialization of research results, then there must be more cutting-edge research to choose from. The 1999 Budget provided much welcomed news in committing an additional \$217.5 million over three years to the federal Granting Councils, an additional \$30 million per year for NCEs and an additional \$200 million to the endowment of the Canadian Foundation for Innovation. These measures will enhance Canadian universities' capacity to generate new discoveries that will form the basis for an ongoing contribution to the economic and social well-being of Canadians.

**Figure 3: Canada/U.S. Comparison of Government-Funded Higher Education R&D, as a Percentage of GDP**



Source: OECD Main Science and Technology Indicators, 1999 [electronic database]

Unfortunately, even with the enhanced level of research funding committed in Budget 1999, Canada will continue to lag behind the United States in terms of the public investment in university research relative to the size of our economies, as shown in Figure 3.

A recent study by the Centre interuniversitaire de recherche sur la science et la technologie provides further evidence that the Canadian federal government invests relatively less in university research than is the case in the United States.<sup>20</sup> They found that the average research grant provided to American university researchers is three times the size of Canadian research grants. In addition, 73 percent of American university research was supported by the federal government in 1996, compared to 47 percent for Canadian universities.

Canada cannot afford to harvest past investments without replenishing universities' capacity to generate new knowledge in areas that will form the basis for longer-term benefits.

#### 4.4.2 Indirect Cost of Research

In the United States, federal research grants cover the salary of the principal investigator that is attributable to the research project, and other indirect costs. In Canada, the federal Granting Councils and NCEs pay only the direct costs of research. In the vast majority of cases, indirect costs (including the salary of the principal investigator) must be provided by Canadian universities out of their income from provincial grants, tuition fees and private donations. This situation is impeding innovation in two ways.

First, it limits the ability of Canadian universities to perform leading-edge research. Given constraints on provincial funding (which covers the indirect cost of research), universities are sometimes unable to accept federal research funding. This has become an urgent issue requiring federal-provincial resolution.

Second, it is far more difficult for researchers employed by Canadian universities to obtain their institutions' support to conduct research. In the United States, when a researcher secures a federal grant they can more easily negotiate a reduction in their teaching duties in order to pursue their research interest. This is because a portion of the grant pays for the researcher's salary for the period that they will be engaged in the research project. This money can be used by the university to hire a teaching replacement.

Canadian universities, on the other hand, must find the money to hire teaching replacements from within their limited operating budgets. During our consultations, we were informed that in the majority of cases the money to hiring teaching replacements is simply not available. As a result, many faculty members are only able to pursue their research interests during summer months. They claim that this is one of the biggest reasons underlying Canadian universities' relatively worse commercialization performance vis-à-vis the United States. If Canadian governments are serious about promoting research-based innovation, federal and provincial governments must address this issue.

20. Jean-Pierre Robitaille and Yves Gingras. *Le niveau de financement de la recherche universitaire au Canada et aux États-Unis : Étude comparative*. Centre interuniversitaire de recherche sur la science et la technologie – Rapport présenté à l'AUC, 17 novembre 1998.

## 5.0 National Vision

Our vision for the 21st century is to live in a country:

- which manages its investment in university research as a strategic national asset;
- which has successfully positioned science-based innovation as a major contributor to Canada's economic prosperity and social well-being;
- where universities and researchers recognize their responsibility, potential and vested interest in fuelling Canada's ability to innovate and productivity performance;
- where governments demonstrate an unwavering commitment to laying the foundation for a strong and healthy economy by:
  - investing in university research;
  - strengthening universities' commercialization capacity;
  - establishing business conditions conducive to the success of firms which rely on universities as a source of innovation; and
- where governments and universities are held accountable to taxpayers for how the public investment in research is managed.

These principles guided the Panel's deliberations throughout our work on this project. They form the foundation for the action plan we offer in the following section.

## 6.0 Action Plan for the 21st Century

If Canada wishes to maximize the economic and social benefits from its investment in university research, it can no longer allow the status quo to continue. The present laissez-faire approach for commercializing the results of university research is resulting in lost investment opportunities, jobs and social benefits for the country at large. If we are to scale up our activity to achieve our full potential, a bold new approach is required.

The Panel offers a five-point action plan to position science-based innovation as a major contributor to Canada's economic prosperity and social well-being. We encourage governments and universities to act on our recommendations to create a new policy framework for managing intellectual property, strengthen the commercialization capacity of Canadian universities, develop the commercialization skills base, establish competitive business conditions, and fuel the innovation pipeline.

### 6.1 Develop a University Intellectual Property Policy Framework

The Panel urges the federal government to develop a coherent IP policy framework. The proposed policy should apply to all university researchers that receive federal research funding, regardless of their position or affiliation. That is to say, the policy should apply to faculty and students alike, including researchers working for universities and their affiliated hospitals, research institutes and NCEs. This leads us to our first two recommendations.

#### Recommendation #1:

*The federal government should require an explicit commitment from all recipients of federal research funding that they will obtain the greatest possible benefit to Canada, whenever the results of their federally funded research are used for commercial gain.*

The application forms for all federal research funding programs should require the commitment of the applicants to obtain a benefit for Canada if the research results are commercialized. The proposed wording is:

“It is a condition of any grant awarded as the result of this application that in the event that the recipient, or the recipient's institution, exploits any result of the proposed research for commercial gain, there must be the greatest possible benefit to Canada from the commercial activity. By signing this application, the applicant and the applicant's institution commit to making reasonable efforts to meet this condition. Failure to live up to this commitment could result in the suspension or loss of personal or institutional eligibility for federal research funding.”

Although researchers are encouraged to disclose IP that has commercial potential, Recommendation #1 is not intended to apply to research results liberated into the public domain.

## Recommendation #2:

*In order for researchers to qualify for federal research funding and universities to qualify for commercialization support, universities (and their affiliated research hospitals and research centres) should be required to adopt policies consistent with the principles set out below:*

- 1. Universities (and their affiliated organizations) must recognize the importance of research-based innovation as a mainstream activity by identifying “innovation” as their fourth mission, in addition to teaching, research and community service; alternatively, they might explicitly identify innovation as an element of the three missions, as appropriate.*
- 2. All IP with commercial potential (excluding books and journal articles) that was supported in whole or in part with federal funding, must be promptly disclosed by the researcher to the university. Researchers who do not comply will be denied access to future federal research funding.*
- 3. All IP with commercial potential (excluding books and journal articles) that was supported in whole or in part with federal funding, must be disclosed annually by the university to the federal government, provided that such information is not subject to the Access to Information Act.*
- 4. All IP created from research that was supported in any part by federal funding is owned either by the university or by the researcher(s) who created it. In those universities where the ownership of such IP resides with the researcher(s), the IP must be assigned to the university for possible commercialization (subject to appropriate sharing of benefits – see item 9).*
- 5. Universities (and their affiliated organizations) must make reasonable efforts to commercialize IP that they have found to have innovative potential. They must make reasonable efforts to maximize the benefits to Canada by deploying IP in the interest of generating increased wealth for Canada.*
- 6. Universities can assign IP back to the creator under the following conditions: when the university has decided not to pursue commercialization; when the university has been unsuccessful in commercializing the discovery within a reasonable time frame; or when the university and the IP creator both agree that the creator can maximize benefits to Canada without undue conflict of interest.*
- 7. Universities can assign IP to firms when this is considered necessary to ensure the success of the innovation.*
- 8. Universities can assign IP to NCEs, affiliated research hospitals and affiliated research institutes when the university and the assignee both agree that the assignee can maximize benefits to Canada without undue conflict of interest.*
- 9. Universities (and their affiliated organizations) must provide incentives to encourage their faculty, staff and students engaged in research to create IP. These incentives must include appropriate sharing of net benefits from successful commercial undertakings whether in the form of equity or licensing income. These incentives must also include appropriate recognition of innovative researchers in tenure and promotion policies.*
- 10. Universities (and their affiliated organizations) will encourage the participation of small and medium-sized enterprises and, where appropriate, support the creation of spin-off companies in commercializing publicly funded research. Small businesses, including local spin-off companies, will be given priority to license innovations, dependent on finding appropriate businesses and equitable terms.*
- 11. Universities (and their affiliated organizations) must make reasonable efforts to license or assign innovations locally or nationally. Whenever possible, licensing should be to a Canadian company or a Canadian subsidiary of a foreign company. Commitments to Canadian value-added must be obtained when foreign licensing is the only feasible route.*
- 12. The university must designate a senior officer responsible for innovation arising from its research, and establish an organizational capacity to carry out its innovation function.*

Our proposal would require that universities work with their affiliated hospitals, research institutes and NCEs to develop consistent policies that comply with the proposed principles. These policies should be submitted to the federal Granting Councils, in the same manner as universities table their policies on ethics in research in order for their researchers to qualify for research grants. New policy submissions would only be required in the event of a change in policy. Universities will likely require two years to modify their existing IP policies, or create new ones in cases where none exist.

When university research is supported in whole or in part with federal funding, our proposal calls for uniform policies on disclosure, ownership and assignment of IP. In these cases, full disclosure should be required, universities or their researchers should own the IP, and if the IP is to be commercialized, researchers should be required to assign their IP to the university to manage. In our view, universities require complete information (full disclosure) and control (ownership/assignment) over the IP created within their institutions to be able to strategically manage the public investment in research for the national benefit.

At the same time, universities would enjoy considerable flexibility in other areas. The proposed policy framework would establish a clear national objective to create wealth for the benefit of Canada. Universities would have the flexibility to achieve this objective through any combination of licensing and spin-off creation with domestic and foreign partners. It also leaves a great deal of room for diversity in the way universities write their policies to provide incentives to creators, and organize to carry out the innovation function.

The proposed policy recognizes the invaluable role played by researchers in the innovation process. That is why we propose that university policies be re-examined to ensure that they provide incentives to encourage researchers to create IP, through appropriate sharing of the financial benefits that arise from successful commercial undertakings and through appropriate recognition of innovative researchers in tenure and promotion policies. **We further recommend that innovation be included in the missions of the federal Granting Councils and as a criterion for awarding research grants.** This is necessary to ensure that researchers who take up the innovation challenge are fairly rewarded, not only by their universities, but also by the Granting Councils when distributing research grants.

The proposed policy framework should not be interpreted to suggest that with disclosure and assignment, the role of the researcher ends and the university takes over. Clearly, responsibility and accountability should rest with universities to commercialize publicly funded IP in a manner that maximizes returns to Canada. However, in cases where researchers are interested in having an ongoing role

in the innovation process, universities should continue to involve them. In many cases, discoveries can only be successfully taken to the market with the ongoing involvement of the researcher.

We recognize that a select number of Canadian researchers are interested and able to commercialize IP without the assistance of the university. That is why we propose that universities have the flexibility to assign IP to researchers for a number of reasons, including when they are satisfied that the researcher can generate equal or greater benefits to Canada without undue conflict of interest.

At the same time, we recognize that most university researchers are severely constrained in their ability to balance teaching, research and community service responsibilities. Most do not have the time and are not interested in commercializing IP. The proposed policy is expected to generate greater benefits for these researchers than they could have achieved on their own. It would ensure that universities take responsibility for professionally managing researchers' IP, with appropriate sharing of benefits. Consequently, we expect that many faculty researchers would support the proposed policy.

This was confirmed by a recent University of Alberta survey. The Academic Staff Association polled its members in February 1999 to solicit feedback on proposed changes to the university's IP policy, along the lines of what we propose in this report. Fewer than 1 percent of all faculty (19 of 2000) registered objections.

The key to the proposed policy is that universities be held accountable for maximizing returns to Canada. The policy would ensure that they have control over IP with commercial potential. If they choose to assign IP to researchers, firms, or affiliated research hospitals, research institutes and NCEs, they must be satisfied that these arrangements will maximize benefits to Canada. (The following section proposes specific accountability mechanisms.)

For the purposes of the proposed policy, we recommend that IP be defined as an invention, discovery or new idea which the legal entity responsible for commercialization has decided to protect for possible commercial gain, based on the disclosure of the creator. This definition is intended to exclude journal articles and scholarly books, and IP created without federal funding. There are two important elements to this definition. First, the IP must have commercial potential, thereby limiting the number of disclosures submitted to a commercialization office to those that the office is most likely to act on. Second, the definition excludes books and journal articles. There are established traditions and practices for dealing with these, and we do not recommend that this be changed in any way.

Under the proposed policy, researchers have the traditional right to decide whether to publish the results of their research, and in what form. If they choose publication, their results will not become IP that can be protected and commercialized. If, on the other hand, they choose to protect their results for possible commercial gain, those results have to be disclosed to the university. In those universities where ownership of IP resides with the creator(s), any resulting IP has then to be assigned to the university.

The Panel is confident that the proposed IP policy framework will inspire a transformational shift in culture within Canadian universities, as happened in the United States with the passage of the *Bayh-Dole Act* in 1980. (See Annex 8 for a comparison of the policy principles enshrined in the *Bayh-Dole Act* and the proposed Canadian policy framework.)

The proposed approach to managing IP generated from federal funding would also:

- better protect the rights of students and co-inventors;
- provide legal protection for universities against third parties;
- promote resource sharing among universities, hospitals, NCEs and research institutes;
- minimize conflicts of interest; and
- ultimately generate higher economic and social returns to Canada.

For these reasons we encourage provincial governments to introduce similar IP policy requirements.

## 6.2 Strengthen Universities' Commercialization Capacity

The proposed policy framework for managing federally funded IP is a necessary but not sufficient condition for success. Additional funding is also required to help universities strengthen their capacity to take advantage of an improved IP management regime.

Universities should not be expected to fully underwrite the cost of establishing effective commercialization offices. They do not have the resources required and should not be pressured to find the money, as it would no doubt come at the expense of other priorities, if at all. The Panel believes that innovation should become a higher priority for universities, but not at the expense of enabling them to deliver on their teaching, research and community service mandates.

It is also unreasonable to expect the industrial sector to build general university infrastructure. Firms more appropriately play a role in supporting specific R&D projects.

The federal government, on the other hand, invests almost \$1 billion per year in university research and has committed

\$1 billion to upgrade universities' research infrastructure (post-Budget 1999 estimates). Without an adequate additional investment to help universities strengthen their commercialization capacity, these original investments will not yield their anticipated benefits. This leads to our third recommendation.

### Recommendation #3:

*The federal government should invest new and additional resources to strengthen the commercialization capacity of universities in an amount equal to 5 percent of its investment in university research. This new funding is to be invested in the commercialization function and must be additional to the university's current spending. To be eligible for commercialization grants, universities should be required to adopt policies consistent with federal policy requirements (Recommendation #2), submit annual reports of their innovation performance and submit annually updated innovation strategies to the federal Granting Councils. These reports should reflect the shared priorities and performance of the university and its affiliated research organizations.*

The proposed commercialization support should be provided directly to universities' commercialization offices, and not to general operating funds. It should also be provided on the condition that other sources of funds are not withdrawn.

Additional resources would help university commercialization offices: (1) compete for highly skilled personnel in short supply by offering competitive market salaries; (2) hire and/or have access to personnel in sufficient numbers so that the process of invention, disclosure and commercialization is not restricted by their capacity; and (3) identify, protect and add value to IP in order to maximize the resulting benefits to the nation.

We propose that governments hold universities accountable by requiring that they submit annual innovation strategies. Universities should collaborate with affiliated research hospitals, research institutes and NCEs to develop a coordinated strategy for submission to the federal Granting Councils. These strategies should explicitly describe how the university and its partners will seek to assure benefits to Canada, including details on how the money will be allocated and spent by the university and its affiliates.

Commercialization grants should be made available to all universities which submit credible strategies in proportion to their share of the total research investment. The grants should be available to fund the priorities of the institution, whether this involves hiring staff, establishing patent budgets, outreach to the industrial sector, establishing networks, etc.

In order to qualify for commercialization grants in the second and subsequent years of the program, universities should be required to submit annual updates to their innovation strategies and annual performance reports. The federal Granting Councils should take care to minimize the administrative burden on universities by relying on Statistics Canada data, where possible, for meaningful performance measures. If Statistics Canada adopts our proposals in Annex 4, university performance reports might focus on providing complementary case study information that yields insights into local economic impacts, continuing challenges and social benefits.

The social sciences fields have traditionally made a smaller contribution in yielding commercial benefits. In large part, this is attributable to the nature of the science which lends itself to generating public benefits more so than private benefits that can be captured by a firm or individual. That said, we believe that there are more innovation opportunities emanating from social science and humanities research than are known and acted upon. **The time has come to begin experimenting with models for identifying the element of social science that is capable of being commercialized, and mechanisms for achieving commercial outcomes.**

We therefore propose that the federal government's investment amount to 5 percent of the university research funding it provides from all sources, including the Social Sciences and Humanities Research Council. This would entail an annual incremental investment of about \$50 million. If the provinces were to do the same, total support for commercialization offices would rise from 0.7 percent to about 4 percent of the value of sponsored research. (Annex 9 provides our rationale for this level of support.)

We recognize that many university researchers are frustrated with the level of support presently available to them by university commercialization offices. If they are expected to assign IP to universities, it is critical that these offices be properly resourced, and staffed with people who are able to manage the innovation process efficiently and effectively. We need to develop world-class commercialization offices that generate high returns to Canada, and in the process generate higher returns to university researchers than they could achieve on their own. The Panel is convinced that once these offices create wealth among researchers, the culture within Canadian universities will change quickly and innovation will become a real priority.

Several of the people we consulted suggested that NCEs, research hospitals and research centers affiliated with universities should also gain access to incremental funds to support their commercialization efforts. We believe that this would contribute to the ongoing isolation of these operations. In view of the cost of commercializing research, the shortage of people with commercialization skills and the need to bundle IP from different research

projects, it is important to instead encourage the formation of strategic alliances among universities and their affiliated organizations.

Hence, our recommendation that universities be required to submit innovation strategies and performance reports on behalf of their institution and research affiliates. This is also why we recommended earlier that researchers be required to assign IP to the university which, in turn, can assign the IP to an affiliated organization. In this model, one entity is held accountable for maximizing returns to the public – universities. To be effective, universities will need to co-operate and share resources with their affiliated organizations.

We recognize that this recommendation will not provide the less research-intensive universities with sufficient resources to establish their own commercialization offices. The Panel does not believe that every university requires an in-house commercialization presence. Small universities are encouraged to combine their resources to create a single commercialization office serving several institutions, partner with larger universities, or otherwise leverage their capacities.

The Granting Councils should jointly administer the proposed program to reduce the administrative burden on universities. Rather than create a new bureaucracy, we believe that NSERC's Intellectual Property Management Program provides an excellent model that could be expanded.

To ensure that university commercialization offices do not become overly bureaucratic and to ensure that they partner effectively with other organizations, after a five-year period, the Granting Councils should review this initiative. At that time, it may be appropriate to consider providing ongoing support on a competitive basis.

### 6.3 Develop the Commercialization Skills Base

Even with additional financial resources, universities can expect to face difficulties competing for the limited number of people with the academic and business skills required to commercialize research. We need more developmental opportunities and better networking to develop the skills required by university commercialization offices. Better networking among Canadian commercialization offices, and between these offices and the other organizations that comprise our system of innovation, would help people identify and act on best practices. During our consultations, smaller and more remote universities were particularly keen to find ways to learn from their more experienced counterparts and leverage their resources. Networking would have the added benefit of enabling the parties involved to more easily identify and act on opportunities to bundle IP. In an environment where modest research funding is spread thinly across many universities, this is often necessary to create high value innovations. This leads to our fourth recommendation:

#### Recommendation #4:

*With the new funding proposed in Recommendation #3, universities should make the commitment to use their educational resources to develop the people with the necessary entrepreneurial, business and technical skills required to increase the number of successful innovations created from the results of university research. The federal Granting Councils should add to this effort by helping to create national and regional networks to share knowledge, expertise and best practices in this area.*

As employers and educators, universities are uniquely well placed to take the lead in building and upgrading Canada's skills base. University commercialization offices are encouraged to allocate a portion of any commercialization grants received toward the following activities.

1. Implement student internship programs to provide business, science and engineering students with an opportunity to work in university commercialization offices. This would reduce the work pressures faced by the limited staff on hand at commercialization offices, while developing future talent.
2. Implement an exchange program between commercialization offices and venture capital corporations to raise awareness of each others' policies and practices. Over time, these exchanges may contribute to a convergence of cultures and, at a minimum, raise awareness of each others' needs and priorities so that more effective working relations can be developed.
3. Take full advantage of available training opportunities to upgrade the current skills base.
4. Form strategic alliances with the industrial and financial sectors. Each commercialization office should have access to the expertise of a board of directors or advisory board, composed of people experienced in commercializing research. Commercialization offices should also partner with their boards to provide frequent and confidential advice to each newly formed spin-off company.
5. Universities should ensure that all engineering and science students have access to and are encouraged to participate in business courses. Similarly, all business students should have the opportunity to add value to science-based innovations under development in commercialization offices and the university at large.

The Panel also recommends that the federal Granting Councils invite commercialization offices across Canada to a two-day forum to discuss the possibility of establishing

a national association of commercialization offices. In response to the need for a mechanism to enable practitioners to identify opportunities for bundling IP and share best practices, a national association might prove useful in performing the following functions:

1. Develop and manage a database of IP disclosures that is available to each university so that they can identify opportunities for bundling. The association could also proactively seek out domestic and international IP bundling opportunities.
2. Develop training courses that are based on Canadian law.
3. Sponsor conferences, workshops and seminars to bring practitioners together to share knowledge, expertise and best practices.
4. Develop shared communications materials to inform faculty of the benefits of strengthened commercialization offices, and inform the private sector of the opportunities and benefits of collaboration.
5. Develop guidelines to help universities determine how best to establish their commercialization operations and spend the proposed commercialization grants.

#### 6.4 Establish Competitive Business Conditions

Firms which are founded on university research and which are dependent on universities as sources of innovation are the players responsible for turning university discoveries into market opportunities. Their success or failure is a critical factor affecting Canada's ability to reap the benefits from its investment in research. The Panel does not believe that business conditions in Canada are sufficiently competitive with the United States to provide a level playing field.

There is little point creating a university IP policy framework and investing in universities' commercialization capacity, if measures are not also taken to ensure the success of the firms which realize the potential of university discoveries.

We offer the following recommendation to enable the mostly high-tech firms which form strategic alliances with universities to successfully compete in the global knowledge-based economy. (See Annex 6 for a more in-depth discussion of these proposals.)

#### Recommendation #5:

*The federal Department of Finance is encouraged to undertake a wholesale review of Canadian tax policy to ensure that it does not impede and, where possible, supports research-based innovation.*

In the context of this review, we believe that the following measures warrant particularly serious consideration:

1. Reduce the top rates of marginal tax paid on personal incomes, and increase the income threshold which attracts the highest rates of marginal tax.
2. Amend the tax treatment of employee share options: tax should not be levied on any gains from the sale of company shares until those shares are sold; and the whole of the gain between exercise price and exercise value should be considered capital gains, irrespective of the status of the company.
3. Amend the \$500 000 lifetime capital gains exemption to eliminate the Small Business Corporation provision, and to extend the hold period to three years. If a Canadian Controlled Private Corporation (CCPC) provision must be retained, it should require that a company be a CCPC at the time of purchase and for at least one year thereafter.
4. Introduce a Registered Share Ownership Plan which applies to full-time employees of any company, provided they are employed for at least three years prior to the sale of shares. The Plan should provide a lifetime exemption of \$2 million per person, spread across any number of companies and applicable against all gains arising from the difference between the cost and sale price of shares.
5. Reduce the arm's-length restrictions on RRSP investments to attract more capital to newly formed business ventures in which the RRSP holder has an ownership stake. This could be achieved at no additional cost to the government. The increased risk to RRSP holders could be managed through diversification requirements.

## 6.5 Fuel the Innovation Pipeline

The fifth and final leg of our action plan is centered on the need for increased public investments in research. To successfully position science-based innovation as a major contributor to Canada's economic prosperity and social well-being, we require more leading-edge research.

### **Recommendation #6:**

*Governments should increase their investment in university research. They should also resolve, on an urgent basis, situations where universities have difficulties conducting research when federal funding is provided, but when limited provincial support is available for the associated indirect costs.*

We recommend that governments increase their support for both basic research (directed by the university researcher) and project research (directed by universities and industry in partnership).

The federal government should scale up its support for the programs of the Granting Councils and the NCEs. Since the capacity to increase the scale of university-industry programs may eventually be limited by the ability of existing partner companies to increase their level of collaboration, additional efforts are required to involve new industrial partners, particularly small and medium-sized enterprises.

Federal and provincial governments also need to resolve the issue of indirect research costs. The present arrangement leaves little scope for universities to free up the time that their researchers require to pursue their research interests. A more coherent approach is required to ensure that our best and brightest have the opportunity to generate the discoveries that will form the foundation of our country's future economic strength.

## 7.0 Implementation Considerations

We urge the federal government to phase in the recommendations offered in this report. Upon receipt of the proposed commercialization grants, universities will likely require two years to modify their existing IP policies, or create appropriate IP policies in cases where none exist.

The three federal Granting Councils, Industry Canada and the National Research Council should form a secretariat to facilitate implementation of the proposed reforms, and monitor developments to ensure full compliance by 2002. The secretariat should also embark on a communications mission to ensure that universities and their faculty members are well informed of the reforms.

### PHASE 1: Year 2000

#### Recommendation #1:

*The federal government should require an explicit commitment from all recipients of federal research funding that they will obtain the greatest possible benefit to Canada, whenever the results of their federally funded research are used for commercial gain.*

#### Recommendation #3:

*The federal government should invest new and additional resources to strengthen the commercialization capacity of universities in an amount equal to 5 percent of its investment in university research. This new funding is to be invested in the commercialization function and must be additional to the university's current spending. To be eligible for commercialization grants, universities should be required to adopt policies consistent with federal policy requirements (Recommendation #2 with a two-year grace period), submit annual reports of their innovation performance and submit annually updated innovation strategies to the federal Granting Councils. These reports should reflect the shared priorities and performance of the university and its affiliated research organizations.*

#### Recommendation #4:

*With the new funding proposed in Recommendation #3, universities should make the commitment to use their educational resources to develop the people with the necessary entrepreneurial, business, and technical skills required to increase the number of successful innovations created from the results of university research. The federal Granting Councils should add to this effort by helping to create national and regional networks to share knowledge, expertise and best practices in this area.*

#### Recommendation #5:

*The federal Department of Finance is encouraged to undertake a wholesale review of Canadian tax policy to ensure that it does not impede and, where possible, supports research-based innovation.*

#### Recommendation #6:

*Governments should increase their investment in university research. They should also resolve, on an urgent basis, situations where universities have difficulties conducting research when federal funding is provided, but when limited provincial support is available for the associated indirect costs.*

### PHASE 2: Year 2002

#### Recommendation #2:

*In order for researchers to qualify for federal research funding and universities to qualify for commercialization support, universities (and their affiliated research hospitals and research centres) should be required to adopt IP policies consistent with the principles set out in Section 6.1.*

# 8.0 Measuring Progress and Maintaining Momentum

There is a need for greater accountability by governments to report to the public on the benefits generated from taxpayers' investment in university research.

**The Panel recommends that the three federal Granting Councils report annually on the economic and social benefits to Canadians from public investments in university research.** We urge the Granting Councils to collaborate with their provincial counterparts in order to present a holistic picture of the total investment in university research, and the overall benefits generated by that investment.

Since the Granting Councils already have a statutory requirement to report annually to the House of Commons Industry Committee, it may be feasible to piggyback this proposal onto their existing obligations. In preparing their report, public authorities should draw heavily on the information that we propose be provided by Statistics Canada and universities.

The Panel proposes that public authorities evaluate the success of the proposed reforms against a clear set of expectations. While we have not attempted to conduct an in-depth cost-benefit analysis, in our judgement, the benefits of the proposed reforms would far outweigh the costs. If the federal government were to invest \$50 million per year over the next 10 years to strengthen universities' commercialization offices, this measure alone would likely generate significant benefits as shown in Table 5.

We urge the federal government to revisit our proposed vision and action plan every five years to ensure its ongoing currency and effectiveness in driving Canada's productivity performance in the global knowledge-based economy.

**Table 5: 10 Year Total Benefits From Increased Funding for Commercialization Offices**

	Status Quo			Incremental Benefits			Total		
	Licensing	Spin-offs	Total	Licensing	Spin-offs	Total	Licensing	Spin-offs	Total
National Economic Benefits	\$10.1B	\$5.7B	\$15.8B	\$6.1B	\$2.3B	<b>\$8.4B</b>	\$16.2B	\$8.0B	\$24.2B
Jobs	67 980	47 567	115 547	41 220	19 542	<b>60 762</b>	109 200	67 109	176 309
Direct Tax Recovery	\$951M	\$571M	\$1.5B	\$577M	\$235M	<b>\$812M</b>	\$1.5B	\$805M	\$2.3B

## 9.0 Conclusions

Canadians' standard of living is under threat of erosion as a result of our nation's weak rate of productivity growth. Innovation is the key to protecting and strengthening what we have worked so hard to create. In the global knowledge-based economy, innovation is increasingly based on advances in science and technology.

Canadian universities are well-positioned to fuel Canada's economic growth and social well-being. They perform world-class research, graduate highly qualified personnel and perform meaningful community service. Unfortunately, Canadian universities are not achieving their full potential in generating innovations from research results. Canadian taxpayers have a right to expect a greater return on their investment.

Incremental changes will result in incremental gains. This is not the path that will achieve our vision of a nation where science-based innovations make a major contribution to economic prosperity and social well-being. To reach our full potential, we need to manage the public investment in university research as a strategic national asset. This requires a bold new approach.

With a decade of experimentation under our belts, and notable successes in some areas, the Panel is confident that the proposals contained herein will position Canada as a world leader in exploiting knowledge for the benefit of the nation. The time is right, and we have no time to lose.

None of our proposals, on their own, will position Canada to maximize returns on its investment in research. Taken together, however, we believe that the recommendations contained herein would have a dramatic effect in fuelling the Canadian economy and generating social and economic benefits for years to come.

The Panel is grateful for the opportunity to provide guidance on matters of Canadian public policy. We are hopeful that universities, governments, firms, venture capitalists and others with a vested interest in reaping the benefit from the public investment in university research will step up to the plate and do their part. No one stakeholder and no one measure among those proposed will be sufficient to break new ground. All of our efforts will be required if Canada hopes to maximize the economic and social benefits from its investment in university research. And bold new measures are required on all our parts if we hope to move knowledge transfer to the next level and achieve our full potential.

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# Annex 1

## Background Reports

The following reports were prepared for the Expert Panel on the Commercialization of University Research. To obtain copies please visit our Web site at <http://acst-ccst.gc.ca> or call (613) 954-2720.

### 1. University Research and the Commercialization of Intellectual Property in Canada

By: Lori Whewell and Wulong Gu, Industry Canada

Topic: A review of the literature and available statistics on universities' R&D effort and commercialization performance in Canada.

### 2. Paths to Commercialization of University Research – Collaborative Research

By: Janusz Zieminski, Conference Board of Canada

Topic: A report on the commercialization barriers stemming from collaborative research and stakeholders' views on appropriate responses.

### 3. Issues with Respect to Commercializing Canadian University Research

By: Dennis Rank, ARA Consulting Group (A Division of KPMG) and Mireille Brochu (consultant)

Topic: An overview of the core issues affecting Canadian universities' commercialization performance and stakeholder views on appropriate responses.

### 4. Best North American Practices in Technology Transfer

By: Niels Reimers,  
Technology Management Associates

Topic: A report on the best practices in North America for commercializing university research.

### 5. Commercialization of University Research in Europe

By: Jeremy Howells and Carole McKinlay, Policy Research in Engineering, Science and Technology, University of Manchester

Topic: A report on the best practices in Europe for commercializing university research.

### 6. Seed Stage Investment Activity

By: Karen Corkery and Angie Brennand,  
Industry Canada

Topic: An assessment of the empirical evidence on whether Canada faces a seed stage investment gap.

### 7. Inventory of Programs Facilitating the Commercialization of University Research

By: Geoff Nimmo and Angie Brennand,  
Industry Canada

Topic: A summary of the federal, provincial and private sector initiatives that facilitate the commercialization of university research in Canada.

### 8. Registered Employee Share Ownership Plan

By: Jennifer Ryan, Ventures West Management Inc.

Topic: A proposal for a Registered Share Ownership Plan to be established in Canada.

## Annex 2

### Definition of Key Terms

**Basic Research:** Its objective is discovery. Its context is the state of knowledge in the field worldwide. Its format is a program of research activity defined by the investigators. Its merit lies in the importance and excellence of the program, as judged by peers. It educates highly qualified people in finding the sources of current knowledge, in creating new knowledge in the context of current advances around the world, and in understanding its trends and its limitations. Its results are exposed to the review of peers and published openly without additional delay. Priority of discovery is generally the issue, more than the ownership of intellectual property. It may lead to profound benefits to humanity in the long term, but they cannot be predicted in the short term. If it has any short term economic benefits, they are incidental.

**Canada's Innovation Gap:** In 1995, the OECD concluded that Canada has an innovation gap in relation to most of the G-7 nations. The assessment was based on a variety of input factors: a relatively small share of high-tech manufacturing, low R&D spending as a fraction of GDP, weak technology diffusion and adoption by business – mainly SMEs, very low spending on R&D in medium-tech and low-tech industries, lack of skilled people in key areas, information gaps on markets and technologies, etc.

**Discovery:** Sight or knowledge of something previously unseen or unknown.

**Innovation (dictionary definition):** The introduction of something new or different. The difference between an invention and innovation lies in the implementation. Innovations occur with the introduction of the new element into use, not upon conception.

For the purposes of this study, the following sharper economic definition of innovation was used: “**Innovation:** the process of bringing new goods and services to market, or the result of that process.”

*Product innovation* is a new good or service brought to market.

*Process innovation* is a new way of making or doing something.

Product and process innovations both begin with inventions. The inventions are then plugged into the business system which tries to make innovations out of them. That process is as uncertain in its outcome as the research that produced the invention in the first place.

*Marketing innovation* is a new way of bringing a product to market. The product or market may be new as well.

**Innovation System:** The regional network of institutions in the public and private sectors whose activities and interactions initiate, import, modify, diffuse and adopt new technologies. It is made up of units (e.g. firms, universities, governments) that interact through linkages (e.g. legal, political, social, economic and business interactions that involve flows of information, money, materials, services and people) and are shaped by various factors (e.g. markets, natural resources, technical interdependencies, collaborations, and science and technology policies).

**Intellectual Property (IP):** Includes inventions; computer software and databases; literary, artistic, dramatic or musical works, books and papers; educational materials; industrial designs; trademarks; integrated circuit topographies; and new plant varieties.

For the purposes of the proposed federal IP policy, IP is more narrowly defined to include: “an invention, discovery or new idea which the legal entity responsible for commercialization has decided to protect for possible commercial gain, based on the disclosure of the creator.” This definition is intended to exclude journal articles and scholarly books, and IP created without federal funding.

**Intellectual Property Management:** Includes intellectual property identification (reporting, patent disclosures), protection (patenting, registration of industrial designs, etc.), promotion (market studies, business plans, feasibility studies, scale-up plans, demonstrations and prototype development), or commercialization (licensing, research contracts, consulting, spin-off investments).

**Invention:** The conception of an idea and the means or apparatus by which the result is obtained. An invention may or may not be based on a discovery.

**Licence:** An agreement with a client to use the institution's intellectual property for a fee or other consideration (e.g. equity in the company).

**Project Research** (in place of the term “applied research”): Its objective is to solve a problem or achieve some desired result that can be specified to a significant extent but cannot be produced with existing knowledge. Its context is defined more by an area of industrial activity than by a discipline, and the project may involve research in more than one discipline. Its format is a project whose design, schedule, milestones, budget, deliverables, etc. are defined by the investigators and their partners. It educates highly qualified people in finding the sources of current knowledge and in creating new knowledge, and it trains them in putting knowledge to productive use. Its results may have direct economic value and, therefore, require clarity about the ownership of intellectual property. The open publication of research results may be delayed by the need to protect intellectual property. Any portion of the research work conducted by graduate students must meet the university's

academic requirement for a degree. It has short term economic benefits that are sufficiently predictable to attract partners from industry and other sectors to invest their own resources, and it may have long term economic and other benefits to humanity. The training it provides has an immediate benefit for the industrial partner who may offer employment to graduate students and research staff involved in the project.

**Royalties:** Income generated from licensing.

**University Spin-Off Company:** A new company established to either license the university's technology; fund research at the institution in order to develop technology that will be licensed by the company; or provide a service which was originally offered through an institution's department or unit.

## Annex 3

### Considerations in Negotiating Commercialization Agreements

The following considerations are intended to help guide universities through the complex process of negotiating terms of agreements for commercializing intellectual property created at universities.

The formal relationship between a university and its receptor company is typically in the form of a licensing agreement. The university must capture appropriate “value” and recognize that this “value” (especially if it is in the form of equity) can only be maximized if the company performs. Accordingly, the university must understand how to act as a supportive shareholder. This is not a familiar role for most university commercialization offices. The Panel believes that commercialization offices could increase the proportion of equity they receive in early-stage companies by realizing that some of the conditions they seek in licence agreements are contrary to the best interests of their receptor companies.

The first issue is whether the university should receive royalties or equity. Royalties are traditional, but have two disadvantages. First, they depend on the generation of corporate revenues and might be delayed. Second, in most cases the university technology forms only a part of the end product, leading to disagreements on what constitutes a fair return to the university, and to litigation. Owning equity eliminates both of these difficulties.

From the receptor company viewpoint, equity is often preferable because it eliminates disputes as to the relative importance of the technology. In addition, the non-dilutable royalty could impact on the firm’s ability to raise equity. Issuing equity also minimizes the need for ongoing involvement with the university. In some U.S. instances, a combination of “modest” royalties and “modest” equity seems to serve the needs of both universities and firms. University commercialization offices must weigh the cost to themselves and to companies when they bargain for the last available advantage, rather than seek to maximize their overall “win” by encouraging more deals to be done, and by acting as a supportive shareholder.

However, if a university owns equity, its commercialization office must be capable of managing a portfolio of equity investments. In most cases, these offices do not have in-house expertise to take on this responsibility and should seek the assistance of outside management. Once again, the university should act as any other supportive shareholder whose objective is to help maximize the value of their shares.

The key issue is ownership of the technology. Universities have traditionally insisted on permanent ownership of all IP and all improvements, even if the development was paid for by a company and conducted off site. They argue that licences to receptor companies are often permanent and exclusive, and indeed equivalent to granting ownership to a receptor company. In addition, universities believe they must own the IP in order to protect the public good, especially if the research was paid for with public funds. For example, if receptor companies fail, universities feel that they need to be able to take back the technology and try again. If universities insist on permanent IP ownership, this will impact on the proportion of equity they can expect to receive.

Companies prefer to obtain outright ownership of IP for the following reasons:

- licensed technology is not available to secure any debt;
- licences often include operating criteria which, if not met, entitle the university to retract (exclusive) access;
- it is unfair to deny ownership when firms invest in the project;
- if only a part of market use of a patent is used by one company, universities may not be able to re-license the balance to other receptors;
- unless the company owns the technology, it is not easily able to deal with IP for cross-licensing;
- if the company fails, investors would be treated differently than the university which might be able to get its investment back (the equity of universities is effectively secured by an asset not available to others); and
- negotiating the specific terms of the commercialization agreement can be time-consuming and expensive when one party uses the IP and the other owns it.

The present situation is causing frustration among firms and is a barrier to putting together well-funded spin-off companies. In addition, negotiations seem to have few commonalities from project to project, resulting in unnecessarily high costs and legal fees – often exceeding \$50 000 for transactions involving funding at or below the \$500 000 range.

An increasingly adopted solution is for ownership to remain with the university until certain corporate milestones have been met, at which time unrestricted ownership transfers to the company. These milestones can be defined in the negotiation process in several ways, including:

- obtaining a defined amount of equity;
- achieving a revenue base; and
- putting strategic partnerships in place.

While each case is different, negotiations between licensor and licensee could be effectively reduced to two items – the amount of equity to be received in exchange for the technology, and defining the transfer milestones. If all other aspects of an agreement can be captured in standard templates, this will have the following beneficial impacts:

- reduce uncertainty and time spent negotiating agreements;
- reduce legal costs;
- improve odds of winning; and
- improve terms for universities that acknowledge up front that ownership will transfer to the receptor.

Consequently, in striking commercial agreements, universities should:

- carefully consider the relative advantage to them from transferring ownership of IP to receptor companies (compared to retaining a licence), and develop clear policies in this area;
- capture the key elements of licence or transfer agreements in “templates” negotiated with local capital suppliers; and
- adopt uniform policies.

## Annex 4

### National Data Collection Requirements

Statistics Canada's 1998 inaugural Survey of Intellectual Property Commercialization in the Higher Education Sector provides valuable information about Canadian universities' commercialization policies (e.g. IP ownership and disclosure), practices (e.g. patenting, invention disclosures), and results (e.g. licensing deals and spin-offs created). Unfortunately, the data are not presented by institution, preventing in-depth analysis of the relationship between policies/practices and commercial outcomes. Without institution-specific data we cannot, for example, test our conviction that universities that require full disclosure and that own IP or require that IP be assigned to them generate higher commercial benefits while attracting less litigation. In addition, the Statistics Canada data do not enable international comparisons. Again, they cannot be used to test our conviction that Canadian universities are underperforming in comparison to their American counterparts.

AUTM provides helpful institution-specific information for U.S. and Canadian universities, with a particular focus on commercialization outcomes. Unfortunately, the AUTM data do not contain the same breadth of information on university commercialization policies and practices as does the Statistics Canada survey. This limits our ability to identify the factors that contribute most to successful commercial performance, and conduct other meaningful analysis. International comparisons along the lines of that reported in Section 3.0 are possible using AUTM data, provided that the research base is adjusted to overcome methodological challenges. However, with only 14 Canadian universities participating in the annual survey (accounting for about 50 percent of all sponsored research), AUTM is of limited value in drawing national conclusions. For example, since the universities participating in the AUTM survey represent those most advanced and experienced in commercializing research results, conclusions drawn on the basis of this data overstate the Canadian reality.

The Panel supports Statistics Canada's intention to conduct its survey on an annual basis in the context of its proposed S&T Framework exercise. Over time, the quality of the responses is expected to improve as Statistics Canada fine tunes the questionnaire and as universities develop the capacity to establish systems that will enable them to respond to some of the more detailed questions. (This is far more likely if governments act on our recommendation to provide commercialization offices with additional financial resources.)

The Panel applauds Statistics Canada for providing a solid base of information about the commercial undertaking of Canadian universities. To strengthen users' ability to analyze and interpret the data, we offer the following recommendations:

1. Statistics Canada should ensure that its voluntary survey covers all Canadian universities and degree granting colleges that secure public research grants. While we appreciate that most (if not all) universities which perform significant amounts of research responded to the inaugural survey, it is important that Canada develop a capacity to undertake longitudinal analysis. If key universities opt out of future surveys, it will be difficult to accurately compare performance over time.
2. The survey should cover Canada's research hospitals since many are affiliated with universities and are involved in collaborative R&D undertakings. We need to better understand their role in the commercialization of research. We understand that a pilot survey to test an appropriate methodology for their inclusion is presently under consideration, and encourage Statistics Canada to move forward on this front.
3. We urge Statistics Canada to explore ways in which it might work with its U.S. counterparts to collect data which will allow for meaningful comparisons of the rate of return on investments in university research.
4. We encourage Statistics Canada to measure the economic impact of university research by collecting not only the names of university spin-off companies, but also established companies entering into licensing deals with universities. Statistics Canada should monitor the performance of these companies using tax data or direct surveys, and report on the revenues they generate, their equity positions, the investments they attract and the jobs they create over an extended period of time. The portion of these gains that are attributable to industry-university collaboration needs to be better understood.
5. In order to shed light on whether empirical data support the assertions of this report, new questions should be added to next years' survey (e.g. legal costs incurred by commercialization offices). Next years' survey should also introduce new questions to investigate more deeply the frequency, magnitude and causes of benefits leaked to other countries.
6. Finally, the survey should publish university-specific information. We appreciate that users are able to work with the raw data, subject to being sworn in under the *Statistics Canada Act*. However, the more data that is broadly available to the research community, the greater the likelihood that researchers will build on the limited academic literature presently available.

These measures would better position researchers to use Statistics Canada data to investigate the following issues, which we believe warrant further study.

- a) Does empirical evidence confirm the propositions put forth in this report (e.g. that universities generate higher returns on investment with lower litigation costs when they own IP or require that IP be assigned to them, require full disclosure, and provide above average resources to their commercialization offices)?
- b) Are firms which form strategic alliances with universities more competitive, and do they create more jobs than firms which do not? Public authorities will continue to face challenges persuading firms to collaborate with universities without empirical evidence on the extent to which various forms of industry-academic alliances contribute to increased sales and equity, job creation or preservation, and incremental investment.
- c) Are certain commercialization pathways (e.g. licensing to established firms vs. creating new spin-off companies) yielding greater economic benefits to Canada? Licences to foreign firms can attract significant investment to Canada; on the other hand, they can result in lost employment opportunities for Canadians. The creation of university spin-off companies is thought to be an effective way to capture all of the benefits in Canada; but successful spin-offs can become prime acquisition targets by foreign multinational firms. We need a better understanding of the benefits to Canada generated by the various paths to commercialization.
- d) To what extent is Canada's approach to commercializing university research contributing to the development of a highly skilled workforce? It will be important to track, for example, the impact of the proposed reforms on the educational choices of our youth, the ability of Canada to attract highly qualified personnel from other countries, and our ability to retain our best and brightest in Canada.

## Annex 5

### Comparative Analysis of Canada-U.S. Commercialization Performance

AUTM's 1997 Licensing Survey provides an estimate of the total economic benefit generated by the U.S. and Canadian universities, hospitals, research institutes and patent management firms that report to AUTM. To calculate total economic benefits, AUTM reviewed other studies to determine an appropriate multiplier to apply against the value of the licencing income earned by survey respondents. Using this methodology, they estimated that the licencing activities of survey respondents generated an economic benefit of US\$28.7 billion in 1997, supporting 245 930 jobs.

We broke down Canada's share of these benefits on the basis of our proportion of the licensing income earned by all AUTM survey respondents. This leads us to conclude

that the Canadian universities surveyed by AUTM generated economic benefits of US\$0.5 billion in 1997, supporting 3935 jobs (see Section I in Table 1).

However, the economic benefits accruing to Canada should be commensurate with our share of the total investment in research (as opposed to our share of the licensing income). Based on our share of the research investment, we estimate that the benefit to Canada should have amounted to about US\$2 billion in 1997, supporting approximately 16 723 jobs (see Section II of Table 1).

This leads us to conclude that if Canadian universities were as effective in generating commercial benefits as their American counterparts, they would have contributed US\$1.5 billion more in economic benefits and generated 12 788 more jobs in 1997 than was actually the case (Section II minus Section I).

<b>Table 1</b>			
	Total * (Canada and U.S.)	Canada	U.S.
<b>Section I: Canada's Share of Economic Benefits</b>			
Proportion of Licensing Income	100%	1.6%	98.4%
Economic Benefit (US\$ Billions)	\$28.7	\$0.5B (1.6% x \$28.7B)	\$28.2B (98.4% x \$28.7B)
Jobs per Year	245 930	3935 (1.6% x 245 930)	241 995 (98.4% x 245 930)
<b>Section II: What Canada's Share Should be Based on Our Relative Investment in Research</b>			
Proportion of Total Sponsored Research	100%	6.8%**	93.2%
Economic Benefit (US\$ Billions)	\$28.7	\$2.0 (6.8% x \$28.7B)	\$26.7 (93.2% x \$28.7B)
Jobs per Year	245 930	16 723 (6.8% x 245 930)	229 207 (93.2% x 245 930)
<b>Section III: Opportunity Loss (Section II – Section I)</b>			
Economic Benefit (US\$ Billions)		\$1.5 B	
Jobs per Year		12 788	
* The calculations presented in the adjacent columns were prepared by the Expert Panel on the basis of AUTM data.			
** We increased by 50 percent the Canadian research expenditure figures reported to AUTM to account for indirect costs included in U.S. but not Canadian data.			
Source: AUTM 1997 Licensing Survey			

## Annex 6

### Detailed Tax Recommendations – Employee Share Options

Employee share options are a tool commonly employed in the technology industry to provide employees with an incentive to strengthen the economic value of their firms. The most effective share option plans for technology companies allocate options to all employees at a favourable price; allow options to “vest” (become eligible to be exercised or bought) over a three- to five-year period; establish vesting conditions which relate to personal and corporate performance as well as length of employment; and provide employees with a long period of time to exercise their options (typically five to 10 years). The taxation of employee-owned shares in Canada is extremely complex, and difficult for employees to grasp.

Under the present tax regime, all Canadians must include in employment income the difference between the value of a share when purchased from their company and the cost of buying it. The cost is often the exercise price of the option. If the company is not a Canadian Controlled Private Corporation (CCPC), the employee must pay tax on this employment income in the year when the shares are bought, whether or not the shares are sold. This has the harmful effect of requiring the payment of income tax when there might be no cash to pay the tax, and obviously reduces the value of the options (especially if some of the resulting shares must be sold to pay the tax). So far as the Panel can determine, there is no other Canadian instance where this type of treatment occurs. ***The Panel recommends that for employees of all companies, no tax be levied on gains from the sale of company shares until those shares are sold.***

If an employee is granted options at an exercise price which is at or above the value of the shares on the day the option is granted, only 75 percent of the employment income (gain) is included in the tax base on which the employee pays taxes. The situation is more complex when the exercise price is below the value of the shares on the day the option is granted. In the case of an employee who works for a non-CCPC, 100 percent of the employment income will be taxed. On the other hand, only 75 percent of the gain is taxed for CCPC employees, provided the shares are owned for at least two years. Under no circumstance are any of these gains considered to be eligible for capital gains treatment. Furthermore, since the status of the company is not an issue when the employees' shares are sold, shares purchased the day before a company goes public (i.e. when it is still a CCPC) give employees a large benefit not available to employees of public companies. ***The Panel recommends that the whole of the gain between exercise price and exercise value be considered capital***

***gains, irrespective of the status of the company (CCPC or not).*** This would make all gains by employees eligible for the lifetime \$500 000 exemption.

All Canadians can accumulate a lifetime exemption from paying taxes on capital gains of up to \$500,000 on the ownership of shares in some companies. This applies to investors and employees. However, as noted above, this is of limited use to employees because the only part of the gain between what they pay for shares and the sale price which counts as capital gains is the difference between what the shares are worth on the day they buy them and the sale price. This problem is addressed in the above recommendation.

Shares eligible for lifetime capital gains exemption must be held for at least two years. In addition, at the time of purchase and sale, the company must be a CCPC, and must pass a further restrictive test (be a Small Business Corporation – 90 percent of its assets must be employed in Canada in an active business for at least two years). The company has similar but less onerous tests to meet.

Anecdotal evidence suggests that these rules distort company operations (e.g. discourage expansion into the US) and create artificial balance sheet gyrations at crucial dates (e.g. the rules can result in different treatment for employees who buy shares at different times). It also means that if the company is successful and expands to have part of its operations in the U.S., employees who worked hard to make this happen might lose their exemption. ***The Panel recommends that the \$500 000 exemption be amended to eliminate the SBC provision and that the hold period be changed to three years.*** If a CCPC provision must be retained, it should require that a company be a CCPC at the time of purchase and for at least one year thereafter. Such a provision would also encourage investment by “angels” in early-stage companies.

The above-noted measures would still leave the tax treatment of options for Canadian employees at disadvantageous levels compared to the U.S. The Technology Industry Association of B.C. has recently sponsored a proposal to provide up to \$2 million of lifetime exemptions from gains on shares owned by employees. This is known by the name Registered Share Ownership Plan (RSOP). The proposal contains restrictions deemed adequate to prevent fraud and to ensure that benefits result from long-term growth. The cash flow to governments from the collection of other taxes would be positive from the beginning. In addition, their proposal would benefit employees at all levels, not just senior management. It would also allow employees to benefit directly from their firms' growth.

*The Panel recommends that the federal government introduce the proposed Registered Share Ownership Plan.*

- The plan should apply to all bona fide full-time employees of any company (whether or not a CCPC), provided they are employed for at least three years prior to the sale of shares.
- The plan should provide a lifetime exemption of \$2 million per person spread across any number of companies and applicable against all gains arising from the differential between the cost and sale price.
- Hold periods of the shares should be lengthy (five years for shares bought for no less than the fair market value; seven years for shares bought at less than fair market value).
- Losses on RSOP shares should not be eligible to reduce other income or capital gains.

For more information on this proposal, please see the paper entitled “Registered Employee Share Ownership Plan” on our Web site at <http://acst-ccst.gc.ca>

## Annex 7

### Seed Stage Sources of Capital

**Canadian Medical Discoveries Fund (CMDf):** CMDf is comprised of several funds that support promising research and commercialization in Canadian universities and affiliated laboratories. One example, the Medical Discoveries Commercialization Fund, targets ideas emerging from laboratories, and offers legal advice and patent processing assistance in return for right of first refusal to license intellectual property. CMDf also includes Med-Tech Partners (funding for opportunities in Quebec universities and research institutes) and Neuro (funding for neuroscience). Additional information can be found at <http://www.cmdf.com>

**Canadian Science and Technology Growth Fund:** The fund invests in early stage discovery and the commercialization of research in the natural sciences, engineering and technology sectors. Additional information can be found at <http://www.cstgf.com>

**Eastern Technology Seed Investment Fund:** This fund is aimed primarily at commercializing promising research projects at universities and other facilities in Eastern Canada. Entrepreneurial and management skills development opportunities are also provided. Additional information can be found at <http://www.easternseed.com>

**Milestone Medica Corp.:** Provides funding and management assistance to Canadian universities and research centres in the biomedicine field. Additional information can be found at <http://www.royalbank.com/kbi/lifecycle/seedstage/milestone.html>

**Seed Management Inc.:** This \$10 million fund invests in British Columbia-based seed stage ventures and spin-outs from research institutions. Additional information can be found at <http://www.ei.gov.bc.ca/website%2Dold/site2/directory/bctio/finance/hightech.htm>

**T<sup>2</sup>C<sup>2</sup>:** Provides financing and management support for the commercialization of technologies developed in Quebec universities and research institutions. Additional information can be found at <http://www.t2c2capital.com>

**University Medical Discoveries Inc.:** Provides early stage, high risk capital for the commercialization of Canadian biomedical innovation emanating from Canadian universities. Additional information can be found at <http://www.umdi.net/>

**Western Technology Seed Investment Fund:** This fund is aimed primarily at commercializing promising research projects at universities and other facilities in Western Canada to support new products in agriculture biotechnology and other high-tech industries. Additional information can be found at <http://www.westernseed.com>

### Comparison of the Proposed Canadian Intellectual Property Policy and the U.S. Bayh-Dole Act\*

Provisions of the <i>Bayh-Dole Act</i> **	Proposed Canadian Policy Principles
<p>Universities are required to determine in a reasonable time period whether they will take title of federally funded inventions. If they choose not to, title may revert to the federal government. Universities are restricted in their ability to assign title to any other party.</p>	<p>Universities are required to determine in a reasonable time period whether they will take title to federally funded IP. They may elect to assign title back to the inventor under the following circumstances:</p> <ul style="list-style-type: none"> <li>(a) if the university has decided not to pursue commercialization;</li> <li>(b) if the university fails to commercialize the innovation within a reasonable period of time; or</li> <li>(c) if the university agrees that the inventor can maximize returns to Canada without undue conflict of interest.</li> </ul> <p>Universities may assign IP to firms when this is considered necessary to ensure the success of the innovation.</p> <p>Universities can assign IP to affiliated research organizations (e.g. hospitals, research centres and NCEs) if they determine that the other party can maximize returns to Canada without undue conflict of interest.</p>
<p>The university must disclose inventions to the federal government in a reasonable time period. Failure to do so entitles the government to take ownership of the undisclosed invention.</p>	<p>The university must disclose IP to the federal government annually, provided that such information is not subject to the <i>Access to Information Act</i>.</p>
<p>Once a university takes title to a federally funded invention it must file patent applications in a reasonable time period, otherwise title reverts to the federal government.</p>	<p>Once a university (or affiliated organization) takes title to IP arising from federally funded research, it must make reasonable efforts to commercialize IP in a manner that maximizes benefits to Canada.</p>
<p>The government retains a non-exclusive right to utilize any innovations that it needs.</p>	<p>The government retains a non-exclusive right to utilize any IP that it needs.</p>
<p>The federal government requires periodic reporting by universities on commercialization efforts.</p>	<p>The federal government requires annual reporting by universities on commercialization efforts.</p>

*Continued on page 48*

\* In the U.S., inventions are defined as “any invention or discovery which is or may be patentable or otherwise protectable.” The proposed Canadian policy would apply to IP defined as “an invention, discovery or new idea which the legal entity responsible for commercialization has decided to protect for possible commercial gain, based on the disclosure of the creator.” This definition is intended to exclude journal articles and scholarly books, and IP created without federal funding.

\*\* Adapted from Etzkowitz (1998)

<p>Universities are required to share royalties with inventors, and use any net gains to support scientific research or education.</p>	<p>Universities (and their affiliated organizations) are required to share royalties and equity with inventors, and use any net gains to support scientific research or education. Tenure and promotion policies must also appropriately reward innovative researchers.</p>
<p>Universities may not grant exclusive rights unless the invention is manufactured substantially in the U.S.</p>	<p>Universities (and their affiliated organizations) will use reasonable efforts to license or assign innovations locally or nationally. Whenever possible, licensing should be to a Canadian company or a Canadian subsidiary of a foreign company. Commitments to Canadian value added should be obtained when foreign licensing is the only feasible route.</p>
<p>Small businesses are given priority when licensing innovations in cases where they submit equally credible plans as larger firms.</p>	<p>Small business, including local spin-off companies, will be given priority to license federally funded IP when they submit equally credible plans as larger firms.</p>

## Annex 9

### Justification for the Proposed Level of Support for University Commercialization Offices

#### **Rationale #1:**

*Based On The Natural Sciences And Engineering Research Council's Activities*

#### **Key Element:**

Staffing of technology commercialization specialists (TCS).

#### **Assumptions:**

University commercialization offices require two TCS for every 150 faculty members active in research (consistent with the requirements of the University of Alberta – see rationale #2). This translates into two TCS for a faculty of engineering and science.

The annual expense per TCS is about \$100 000 to cover operating costs (salary, benefits, office operation costs, internal project/program support, miscellaneous supplies, travel, staff development and capital asset maintenance).

Canada's top 10 universities also require about \$1 million per year to protect intellectual property (IP), build prototypes, and otherwise add value to university IP in order to attract early-stage investment.

NSERC's research budget in 1998/99 was \$494 million.

#### **Analysis:**

NSERC supports 7500 faculty members across Canada.

Assuming the need for two TCS per 150 faculty members, this translates into a requirement for 100 TCS across all universities to commercialize research funded by NSERC.

The total cost to support TCS would be \$10 million per year (100 x \$100 000).

Additional costs would need to be incurred by commercialization offices to add value to university IP. The cost of these functions is about \$10 million per year for the top 10 universities that receive NSERC funding.

Since the top 10 universities receive two-thirds of NSERC's funding, an extrapolation results in a total cost for value-added functions of \$15 million per year (\$10 million x 3/2).

Adding the \$10 million cost for TCS and the \$15 million for IP value added, results in a total cost estimate of \$25 million to operate commercialization offices from NSERC's activity alone.

This amounts to 5 percent of NSERC's investment in research (\$25 million ÷ \$494 million).

#### **Rationale #2:**

*Based on a Proposed Operating Budget for Commercialization Offices*

The following is a "generic" model, based on the resource requirements of the University of Alberta's Industry Liaison Office. It reveals that even one of the better funded commercialization offices in Canada requires financial resources above the proposed 5 percent of federal research funding.

There are four fundamental building blocks in a successful, university commercialization office: the core business; specialized support to core business; office operations; and the Directorate of the commercialization office.

The "core business" is focussed on technology licensing and spin-off company development. The "specialized support" for these activities is a blend of in-house legal and intellectual property expertise, prototype development funds, patent funds, specialized assistance in industrial grants/contracts that are commonly tied to licensing and spin-off opportunities, and marketing and business development with external clients in the public and private sector.

The "office operations" include database and financial management, communications, office operations management, and reception/clerical/filing functions. The "Directorate" consists of the CEO and senior level executive secretary/assistant.

The key element in this proposed generic technology commercialization office is to have a dedicated team (technology commercialization manager and assistant) in each disciplinary area producing potential commercial technology opportunities. In an institution such as the University of Alberta this would translate into seven teams as follows: one team for each of the Faculties of Science, Agriculture, Forestry, and Home Economics; Engineering; two teams for the Faculty of Medicine and Oral Health Sciences; and one team for each of the remaining grouped faculties: (a) other health sciences (Pharmacy and Pharmaceutical Sciences, Rehab Medicine, Nursing and Physical Education) and (b) Arts, Social Work, Education, Business, and Law.

Underpinning the above would be the balance of the core business, associated support, and office operations: Spin-Off Company Manager and assistant; Prototype Development Program Manager and assistant; IP/Legal Manager and two staff; Financial Manager, Office Manager, Database

Manager, Communications Officer, and Marketing/  
Business Development Manager and assistant. Add to this  
the positions of Director and Executive Secretary/Assistant.

The staff complement as outlined above consists of essentially 13 “senior” professionals and 16 more junior and support staff. Overall, the commercialization office’s operating costs (salary, benefits, office operation costs, internal project/program support, miscellaneous supplies, travel, staff development, and capital asset maintenance) can be realistically projected at the equivalent of \$100 000 per staff member. This projection is based on comparisons with other public-sector organizations such as the Alberta Geological Survey, Alberta Economic Development and the Alberta Research Council. Thus, the overall annual office operating base budget would be in the order of \$2.9 million.

In addition to the operating costs, targeted internal funds are required to support both the intellectual property protection (patent) costs, and the value-adding prototype development program. Together these two important functional areas would require on the order of \$1 million per annum of additional revenue.

In sum, the total annual cost to operate the commercialization office is \$3.9 million.

The University of Alberta’s research funding from the three granting councils currently consists of \$24 million from NSERC, \$19 million from MRC and \$3.5 million from SSHRC, for a total of \$46.5 million. If we assume that 5 percent of the total Tri-Council research budget is allocated toward new investment in university commercialization offices, then the University of Alberta could be eligible for \$2.3 million.

The \$1.6 million shortfall would need to be secured through: (1) internal core funding from the University (\$600 000); and (2) targeted, project/program-specific funding from the provincial government and private sector stakeholders (\$1 million).

