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TECHNOLOGY TRANSFER WORKSHOP ISSUE PAPER

BASED ON A WORKSHOP HELD AT BLAKES LL.P.
IN MONTREAL ON APRIL 20TH, 2004

August 2004

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This document was prepared by researchers at the Centre for Intellectual Property Policy (CIPP) at McGill's Faculty of Law.

The Centre wishes to thank Julia Carbone, Karen L. Durell, E. Richard Gold, Elisa Henry and Ilana Liechtenstein for their work on this document.

This document's recommendations and conclusions are the result of a consensus and do not necessarily reflect the opinions of individual workshop participants.

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INTRODUCTION

> Ideas and discoveries will be the currency of the 21st century. And that currency must be Canadian.[1]
>
> Prime Minister Paul Martin

In order for Canada to reap the benefits of the 21st century currency, it must not only foster the development of new ideas and discoveries, it must also find ways to commercialize Canadian technology. One of the key ways to do so is through university to industry technology and knowledge transfer.[2]

The importance of technology and knowledge transfer to both the Canadian economy and universities prompted the Centre for Intellectual Property Policy at McGill University in Montreal, Quebec, to hold a one-day workshop with leaders from industry, universities, government and the research community on April 20, 2004.[3]

The goal of the Workshop was two-fold: 1) to identify the concerns regarding technology and knowledge transfer that are common to researchers and industry; and 2) to suggest ways that government, industry and universities can address these concerns. The forum was intended to address not only important issues relating to technology and knowledge transfer, but also to pinpoint the present concerns of those persons working closely with Canadian innovation (e.g. researchers, university administrators, industry representative and policymakers).

Part I of this report provides a background discussion of technology and knowledge transfer in Canada.[4] Part II gives an overview of the Workshop's goals and its proceedings. Part III identifies specific recommendations reached through consensus of the Workshop participants.

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[1] Paul Martin, (Remarks by the Right Honourable Paul Martin, Prime Minister of Canada on the occasion of the Canada Foundation for Innovation National Funding Announcements, Ottawa, Ontario, Canada, March 8, 2004), online: <http://www1.pm.gc.ca/eng/news.asp?id=107>.

[2] Technology and knowledge transfer can be generally defined as the process by which research produced by a transferor is conveyed to a transferee. Technology and knowledge transfer is not a static form of transaction and relates not only to technology *per se* but knowledge about the use of technology. The types of entities involved, the form of technology and knowledge and the rights in the technology and knowledge that are transferred can vary from one technology transfer transaction to the next.

[3] Details of the conference are provided in Part I of this paper.

[4] For the purposes of this report, we focus on technology and knowledge transfer whereby technology and knowledge are passed from a university to industry. We also assume that the transfer is conducted for the express purpose that the research will be developed into a commercial product by industry.

I. BACKGROUND

Technology and knowledge transfer is important to Canadian innovation policy as multiple indicators suggest that Canada is lagging behind other countries in innovative development. For example, despite the fact that Canada places seventh in the Organization for Economic Co-operation and Development ("OECD") income per capita ranking, Canada has the lowest rate of productivity among G-7 countries - a full 19% lower than the United States.[5] Currently, Canada's innovation capacity is near the bottom of the world's leading economies.[6] This is troublesome and hinders Canada from reaping the benefits of the new currency.

Canadian universities act as the 'mint' of much of the existing innovation. The Advisory Council on Science and Technology found that universities perform 21% of all Canadian research and development, account for 31% of Canada's research and development personnel, and generate 65% of all Canadian scientific publications.[7] Industry then develops these ideas and discoveries into practical commodities.[8]

In order to be able to exploit a discovery, private industry must have rights to the invention. Usually, a university or researcher will grant rights in a discovery - most often the rights are a form of intellectual property right - to industry through licensing, assignment, or outright purchase agreements. Thus, to cash in on the new currency,

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[5] Innovation Canada, Government of Canada, "Canada's Innovation Strategy; National Analysis", online: Innovation Canada <http:// innovation.gc.ca/gol/innovation/interface.nsf/vSSGBasic/in02206e.html>.

[6] Robert Giroux, "Enhancing Innovation Capacity in Canadian Universities", (Presentation to the House of Commons Standing Committee on Industry, Science and Technology, May 15, 2001), online: Association of Universities and Colleges of Canada <http://www.aucc.ca/_pdf/english/reports/2001/indust_05_15_e.pdf>, at 3.

[7] Canada Advisory Council on Science and Technology ("ACST"), "Public investment in university research: reaping the benefits", (Report of the expert panel on the commercialization of university research, May 4, 1999), online: ACST <http: //acst-ccst.gc.ca/comm/rpaper_html/report_4_e.html>.

[8] A university or researcher may choose to create a new company dedicated to the exploitation of a technology into a viable product and thereby control the entire development process themselves thereby avoiding the intervention of an outside corporation. New companies created for the purpose of developing a technology outside of the public research base are commonly referred to as "spin-off" corporations. As noted by the Organisation for Economic Co-operation and Development ("OECD"), "research-based spin-offs are generally understood to be small, new technology-based firms whose intellectual capital originated in universities or other public research organisations. These firms are thought to contribute to innovation, growth, employment and revenues. They are perceived to be flexible and dynamic, giving rise to novel fields and markets, and playing a critical role in the development of high-technology clusters." OECD, "Introduction: The New Spin on Spin-offs" (27 July 2001), online: OECD <http://www.oecd.org/document/57/0,2340,en_2649_34409_2046201_1_1_1_1,00.html>.

Canada must ensure that discoveries and know-how are effectively transferred between industry and universities.

II. OVERVIEW OF THE WORKSHOP

The Workshop brought together a group of experts for a one day conference (a complete list of participants in attendance at the Workshop is provided at Appendix A). At the Workshop, participants were provided with a list of questions to initiate conversation. The list covered the following topics: 1) whether technology transfer may, or may not, provide a means of securing a reliable source of funding for Canadian universities which as a class are in need of support; 2) the increased commercialization of university research and its potential as a tool to stimulate the economy; 3) methods of licensing technology which recognize and are formulated based upon the fact that upstream technology may have downstream uses; 4) coordination problems experienced in the course of research conducted amongst multiple institutions (e.g. amongst several universities) as well as research spanning the private and public sector; 5) the role of researchers in the commercialization of their work; and 6) the management of the costs and risks relating to the development of early stage research originating from universities. A complete list of the questions is included in Appendix B of this report.

Workshop participants were divided into three discussion groups. The groups met during two breakout sessions to raise and review issues. During the first breakout session, each group was asked to identify problems stemming from current technology transfer practices. Then, groups were encouraged to develop five or more recommendations to address these problems. The focus of the second breakout session was then to prioritize the recommendations.

The Workshop concluded with a final session where participants attempted to reach a consensus on the priority of the issues and recommendations identified by the individual groups.

Ultimately, participants reached consensus on four primary recommendations. This report will address each recommendation individually. One should note, however that while all participants took part in the discussion and consensus building process, individual participants should not be understood to necessarily endorse the final recommendations or conclusions resulting from the Workshop.

III. Recommendations

Workshop participants developed four recommendations as follow:

1) **That federal granting agencies and federal governmental departments responsible for scientific and technological development create a forum to develop a Canada-wide technology and knowledge transfer strategy and to develop mechanisms to reduce transaction costs which result from a lack of intellectual property policy harmonization.**

2) **That the forum created in Recommendation #1 develops a strategic framework to guide technology and knowledge transfer. This could involve the development of flexible model agreements and protocols to be adopted by universities and industries to aid in the process of the negotiation of licensing.**

3) **That an expert group investigate mechanisms to fund development from the research phase through to the development of a prototype in order to remedy the current funding gap for technology development.**

4) **That universities develop internal training strategies for researchers and technology transfer officers to educate them with respect to intellectual property laws and the management of intellectual property and knowledge.**

RECOMMENDATION #1:

That federal granting agencies and federal governmental departments responsible for scientific and technological development create a forum to develop a Canada-wide technology and knowledge transfer strategy and to develop mechanisms to reduce transaction costs which result from a lack of intellectual property policy harmonization.

Workshop participants highlighted the lack of harmonization between granting agency and university intellectual property rules, the lack of standardized Canadian license agreements and the lack of clear policy goals as a significant impediment to technology and knowledge transfer in Canada. Participants reached consensus that, as a first step in remedying this problem, both federal agencies responsible for funding scientific research and relevant federal government departments (Industry Canada, Agriculture Canada, Health Canada, etc.) should create a forum through which to discuss how these agencies and departments can produce a technology transfer strategy that would include the development of harmonized intellectual property policies. While any of these agencies or government departments could take the lead in this process, some participants suggested that Industry Canada ought to organize the first meeting of these agencies and departments.

i. Fragmentation

Workshop participants noted that the current Canadian approach to the transfer of knowledge and technology is fragmented. One example of this fragmentation is that all of the parties involved in technology and knowledge transfer - the various federal and provincial granting agencies, the many universities, technology transfer offices (“TTOs”), and venture capital funds - have adopted their own internal policies regarding intellectual

property ownership, management and revenue participation. There is no continuity even amongst categories of institutions. Each organization formulates its own intellectual property policy based on its own objectives but often without sufficient consideration of the interactions between that policy and those adopted by other organizations. For example, universities take vastly different approaches to intellectual property ownership from one institution to another. Some universities grant ownership to the researcher, whereas other universities retain ownership over all innovations achieved by their employees but have some form of revenue sharing mechanism. As a result it is often very difficult to conduct a research project that involves multiple universities. Thus, during the course of any particular research project, all of the institutions involved must agree upon an overarching intellectual property policy. This means some institutions may ultimately be forced to agree to a clause that is contrary to their internal intellectual property policy for the sake of the joint project. Determining whose policy will win out can involve difficult and time consuming deliberations.

During the course of the Workshop, participants identified current Canadian harmonization initiatives. One such example is WestLink Innovation Network[9] ("WestLink"). WestLink is a centralized body that engages in the acceleration of technology transfer in Western Canada and draws members from the Association of University Technology Managers, the Licensing Executives Society, the Saskatchewan Advanced Technology Association, the Alberta Health Industry Association as well as numerous other association and universities in Western Canada. WestLink holds meetings, facilitates sharing of information, conducts workshops on technology and knowledge transfer and works with small and medium size companies (SMEs) to develop their internal capacities. The provision of collaborative opportunities in specific sectors is a focus of WestLink and it will engage in research and policy development related to

[9] WestLink is a not-for-profit organization formed in Western Canada that is dedicated to the facilitation of communication, collaboration, technology development and innovation commercialization. WestLink is comprised of 25 members representing a variety of organizations including: western Canadian Universities; colleges; technical and research institutes. Online: WestLink Innovation Network Ltd. <http://www.westlink.ca>.

member activity. It is WestLink's goal to fill the gap left open by governments, TTOs and funding agencies.[10]

A further attempt to achieve greater harmonization is seen in Quebec. The Quebec Minister of Research, Science and Technology formulated a policy- the *Québec Policy on Science and Innovation - Knowledge to Change the World* (the "Quebec Policy") – aimed at fostering research and development.[11] Technology and knowledge transfer plays an important role in the Quebec policy and it has fostered the creation of several entities. First, a number of corporations have been formed to address product development funding. Second, an interdepartmental body, consisting of representatives from major Quebec departments, university researchers and experts in intellectual property law, has been set-up to oversee internal and external governmental research and development: Valorisation Recherche Québec ("VRQ").[12] Third, Quebec created three mechanisms to support technology transfer. These mechanisms include: 1) *interface* - an interdepartmental budget provision designed to support liaison and transfer offices;[13] 2) *innovation.org* - supporting innovation in public organizations;[14] 3) *innovation.inc* - supporting the effort of companies to increase their capacity to innovate.[15] The centralized Minister of Research, Science and Technology supervises all of these bodies.[16]

Other interesting initiatives include the recently created British Columbia Innovation Council ("BCIC"). BCIC will focus on economic development and provide support for high technology companies, educational institutions, technology awareness

[10] WestLink Innovation Network, "About WestLink", online: WestLink Innovation Network Ltd. <http://www.westlink.ca/about.htm>.
[11] Quebec Minister of Research, Science Technology ("MRST"), "Quebec Policy on Science and Innovation - Knowledge to Change the World" (2001), online: MRST <http://www.mderr.gouv.qc.ca/mdercontent/000021780000/upload/publications/pdf/science_technologie/fr/pqsi/mrst_savoirchanger.pdf > (hereinafter the "Quebec Policy"). Since the introduction of the Quebec policy document the MRST has further developed a strategic plan based upon their 2001 policy entitled, "Plan Strategique 2001-2004", online: MRST <http://www.mderr.gouv.qc.ca/mder/web/portail/ministere/nav/Publications.html?&page=details_publication.jsp&iddoc=44032 >.
[12] VRQ is a not-for-profit organization created in 1999 to fund university research in the province of Quebec. Presently VRQ funds four sociétés de valorisation universitaires ("SVU") which include Sovar, Gestian Valeo, Univalor, and USBi Capital. See online: Valorisation Recherche Quebec <http://www.mderr.govv.qc.ca/mder/web1portail/sciencetechnologie/nav/valorisation_transfert >.
[13] The Quebec Policy, *supra* note 11.
[14] *Ibid*.
[15] *Ibid*.

groups, federal agencies and university research labs. BCIC is also expected to take over the Science and Technology fund that is presently administered by the British Columbia Ministry of Small Business and Economic development.[17]

Other federal agencies intended to respond to multiple aspects of technology and knowledge transfer include: the National Research Council's Industrial Research Assistance program; Innovation in Canada; Technology Partnerships Canada; and Federal Partners in Technology Transfer ("FPTT").

Despite all of the aforementioned initiatives, there has been to date no effort to create a Canada-wide technology and knowledge transfer policy. A consensus was reached that a national initiative should be undertaken with the prime goal of achieving harmonization of intellectual property policies.

ii. Getting Started

In order to implement Recommendation #1, Workshop participants discussed which Canadian entity involved in technology and knowledge transfer should take a lead in facilitating national discussion regarding intellectual property policy harmonization. Ultimately they remained undecided. The majority of participants believed, however, that Industry Canada would be an appropriate choice. This would place Canada in a similar position to that of the United States where a governmental department administers technology transfer related policies.[18] Industry Canada, as the federal department involved in commercial transactions and relevant policy, is already dedicated to fostering a growing, competitive, knowledge-based Canadian economy in that it acts to improve Canada's innovation performance. [19]

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[16] *Ibid*.
[17] Minister of Small Business and Economic Development, British Columbia, Press Release, "New Technology Agency to Target Economic Development" (23 April 2004).
[18] In the United States the Department of Commerce has been assigned the task of maintaining the regulations necessary to implement legislative and executive patent and licensing policy regarding "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms", codified as regulations, 37 CFR Part 401, corresponding to the *Bayh-Dole Act*, 35 U.S.C. s200-212 (1985), as well as the regulations corresponding to the *Technology Transfer Commercialization Act of 2000*, P.L. 106-404 (2000). These U.S. regulations constitute a significant proportion of the government's policy framework on technology transfer. It was argued by some of the Workshop participants that the U.S. Department of Commerce and Industry Canada fulfill similar roles in their respective countries.
[19] Industry Canada, Government of Canada, online: <http://www.ic.gc.ca/cmb/welcomeic.nsf/ICPages/Mandate>.

The FPTT, a network of federal public servants from science-based departments and agencies, may also be a good choice to spearhead an intellectual property policy harmonization initiative.[20] The mission of the FPTT is to enhance the transfer of technology and knowledge from government research laboratories to industry. Although the FPTT focuses on the transfer of government laboratory work it could expand its mandate to deal with the dissemination of university research.[21]

[20] Some of the participants in the FPTT include: Canadian Space Agency; Agriculture and Agri-Food Canada; and Environment Canada.
[21] Federal Partners in Technology Transfer, Government of Canada, online: Federal Partners in Technology Transfer <http://www.fptt-pftt.gc.ca/main_e.shtml>.

RECOMMENDATION #2:

That the forum created in Recommendation #1 develops a strategic framework to guide technology and knowledge transfer. This could involve the development of flexible model agreements and protocols to be adopted by universities and industries to aid in the process of the negotiation of licensing.

Workshop participants noted that the lack of a strategic policy framework and of model agreements negatively affects the cost of technology and knowledge transfer. In the absence of either a strategic policy framework or model agreements, each technology and knowledge transfer agreement must be essentially negotiated from scratch. The result is that parties are forced to re-invent the wheel with each agreement, an exercise that can be quite costly due to the time and labor expended in negotiations. Workshop participants suggested that the introduction of a strategic policy framework and model contracts, adaptable to a variety of research sectors, might alleviate much of the present costs of negotiating, drafting and implementing technology transfer agreements.

The discussions of this issue involved two steps. First, the participants identified two possible strategic policy goals that could underlie Canadian technology transfer policy: (1) maximization of revenue for universities and (2) a Canada-first model in which benefit to Canadians and Canadian industry is more important than financial return to universities. The participants further recognized that once a framework is chosen, benchmarks must be established for the purpose of measuring the success of technology and knowledge transfer and of tracking progress. Second, Workshop participants discussed the different kinds of standard agreements. Throughout their discussions, participants were mindful that model agreements must be flexible so as to take into account the nature of the research projects and of market conditions.

i. Strategic policy framework

Workshop participants recognized that the determination of a strategic policy framework must be the first action taken under this recommendation. The strategic policy framework is intended to identify the priorities of technology and knowledge transfer in Canada. This policy would provide guidance to university decision-makers as to which technology and knowledge transfer agreements should be pursued. The two primary frameworks suggested by the participants were the revenue maximizing model and the Canada-first model.[22]

The revenue maximizing model seeks to encourage universities to maximize the revenue they obtain from Canadian innovation. This may involve transferring the technology and knowledge outside of Canada if the private sector actor willing to pay the most for it resides outside our boarders. This means that while the university increases its revenue stream, Canadian industry and the Canadian economy do not directly benefit from the development of the product since this will occur outside of its boarders.

In contrast, the Canada-first model aims to ensure that research is exploited and commercialized in a manner that best supports the creation of jobs within Canada. Such a policy might, for example, embrace the creation of Canadian spin-off companies[23] and emphasize the adoption of measures that would ensure the exploitation of Canadian innovation by Canadian companies. Given that the market for the innovation will be restricted to Canadian-based actors, universities will likely obtain less revenue under this model.

Examples of both models exist. Quebec, for example, has adopted a policy that is Quebec-first.[24] The Quebec Policy has three primary goals:

1. Economic and social development by ensuring that:

a) the creation of wealth by science, technology and innovation also improves the well-being of Quebecers;

b) that the policy is closely coordinated with other Quebec government policy; and

[22] Workshop participants noted that the choice of framework would affect multiple aspects of technology and knowledge transfer. For example, funding would be targeted so as to correspond with the requirements of the framework. This would mean that if a Canada-first model is adopted then Canadian funding sources would be given preference over international sources.

[23] See note 5 for a discussion of spin-off companies.

c) that the policy contributes to the common objective of ensuring the well-being of Quebecers;

2. Development is fair and sustainable; and
3. Culture is enriched.[25]

Quebec has recognized that failure to adopt a consistent strategic policy framework may ultimately impede knowledge transfer.[26]

Another example is the *Bayh-Dole Act* ("BDA") in the United States.[27] The BDA requires universities to give preference to small business firms when looking to market an innovation and hold that all exclusive licensees must not only sell their product in the U.S., but must also substantially manufacture the product in the U.S. In similar vein subsequent amendments under the *Technology Transfer Commercialization Act of 2000* ("TCCA")[28] were intended to facilitate a technology transfer infrastructure that is friendly towards industry.[29]

Workshop participants pointed out that once a strategic policy framework is adopted, clear benchmarks must be defined to ensure that the policy is working. They thus must be created so as to correspond to the priorities set out in the framework. For example, economic factors such as the number of jobs created or the financial success of a project may be considered. Non-economic factors could include the creation of knowledge for the benefit of the public domain. Once the appropriate benchmarks are determined, a project may be assessed in order to determine the likelihood of its success in achieving particular goals.

Participants did not reach a consensus as to which framework is preferable.

ii. Model Agreements

In addition to the need for a strategic policy framework, Workshop participants discussed the benefit of implementing model agreements and protocols to aid in the negotiation of technology and knowledge transfer agreements. Currently there is no

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[24] The Quebec Policy, *supra* note 11.
[25] *Ibid* at 78.
[26] *Ibid*.
[27] BDA, *supra*, note 19.
[28] *Technology Transfer Commercialization Act of 2000*, *supra*, note 19.
[29] U.S. Council on Government Relations, *The Bayh-Dole Act* (1999), online: The Regents of the University of California <http://www.ucop.edu/ott/bayh.html>.

uniformity among universities and TTOs in terms of the provisions and clauses included in these agreements. There are also no guidelines that outline how best to negotiate such agreements. The introduction of model agreements and protocols would provide, at the very least, a foundation from which technology and knowledge transfer agreements could be negotiated and drafted.

In particular, participants discussed how model agreements could include a standard provision pertaining to intellectual property ownership. As has been discussed, intellectual property ownership is initially stipulated by statute, but various methods of transferring ownership are available, including assignment and license. Although it is not feasible for all technology and knowledge transfer agreements to adopt identical ownership clauses, a model agreement may at least offer a standard that could be treated as the default base upon which negotiations can be conducted.

One participant noted that in Quebec there is a modicum of standardization among universities in that most include a clause allowing for a 50/50 split in ownership of intellectual property rights between a university and a researcher. However, in contrast, there is no mandatory provision retaining the ownership of intellectual property rights in any technology and knowledge transfer agreements executed by the University of Waterloo.[30] A technology and knowledge transfer agreement negotiated between the University of Waterloo and a Quebec university therefore has no common ground upon which to start.

Workshop participants pointed to the United States' National Institute of Health ("NIH") as an example of an entity that has implemented model agreements. The NIH funds research and has found that setting-up standard agreements has decreased negotiation costs. Parties who receive NIH funding must abide by the provisions of the BDA and the *Technology Transfer Commercialization Act of 2000*, in the course of negotiation and drafting of technology transfer agreements. In particular, NIH demands that clauses regarding ownership of intellectual property must be in accordance with the

[30] University of Waterloo, "Policy 73 - Intellectual Property Rights" (October 28, 1997), online: University of Waterloo <http://www.adm.uwaterloo.ca/infosec/Policies/policy73.htm> at chapter V. According to Policy 73, any intellectual property rights stemming from "sponsored research" will be allocated subject to the agreement executed by the parties. Thus, a technology transfer agreement may dictate that intellectual property rights be granted to a private corporation, but academic benefits must be derived therefrom in

BDA and its regulations. Thus, the NIH requirements trump all university rules.[31] While discussing the NIH the Workshop participants did note that Canada does not have a similar agency endowed with as much power as the NIH.

exchange for ownership. Essentially this means that academics must have the opportunity to generate and disseminate the knowledge gleaned from the research project in some manner.

[31] NIH, "Part II – Terms and Conditions of NIH Grant Awards", in *NIH Grants Policy Statement* (December 1, 2003), online: < http://grants2.nih.gov/grants/policy/nihgps_2003/nihgps_2003.pdf >.

RECOMMENDATION #3:

That an expert group investigate mechanisms to fund project development from the research phase through to the development of a prototype in order to remedy the current funding gap for technology development.

Workshop participants recognized that it is exceedingly difficult to attract funding for early stage development of high-risk products. This state of affairs adversely affects the generation of Canadian innovation and has a consequently negative effect upon the potential of technology and knowledge transfer to benefit Canada.

Participants recognized that there exist many hurdles that impede the ability of Canadian innovators to attain financing generally. As an initial response, some Workshop participants proposed that a public/private model of funding should be developed. In particular, they advocated the integration of staged funding as an integral facet of this model. Models such as matchmaking, consolidating venture capital, and collaboration were also recommended. In order to develop a definite model, participants agreed on the need for an expert committee to further study the problem. The Centre for Intellectual Property Policy agreed to take on this role.

i. Lack of funding for the early development stage

Workshop participants acknowledged that there is presently a dearth of funding for early stage development of high-risk products. Two main reasons for the funding crisis were suggested: 1) venture capitalists are risk adverse and therefore are not attracted to early development projects; and 2) promised funding is unreliable, arriving in dribs and drabs.

Workshop participants generally agreed that public funding most commonly supports basic research and development. Private investors are only attracted to projects

considered to have great potential for commercial success.[32] Consequently, high-risk projects often are unable to attract funding. In Canada the result is that high-risk projects tend to fall by the wayside. Workshop participants agreed that this poses a significant problem to technology and knowledge transfer since a lack of funding deters the development of Canadian innovation. As a result, the pool of innovation from which revenues may be derived by way of technology and knowledge transfer is diminished. Participants recognized that the best means of combating this problem is to find reliable sources of funding and a means of raising investor interest.

ii. Financing models

Participants proposed a variety of models to deal with the current scarcity of financing generally experienced by all Canadian innovation. It should be noted that the funding shortage presently affects innovation at all stages of progress. A lack of funding occurring at a late trial stage can be just as crippling to innovation as a shortage that interferes with early stage research.

a) Public/private phase funding

Some Workshop participants suggested a model of public/private funding as a possible cure for investor malaise. They felt that a balance of public and private sector funding is required to support high-risk technology creation and that money should be allocated to specific stages in the progression of innovation development.

Currently, there is no model directing how government funding should be utilized to support the development of technologies. Each governmental financing organization has its own unique approach to the provision of funding to development. The participants raised two particular examples of divergent governmental approaches to financing innovation. First, Genome Canada phases-in funding according to the stage of development of a technology. Second, in direct contrast to the Genome Canada financing method, the Canadian Foundation for Innovation ("CFI") provides funding for a percentage of all eligible costs.[33] Participants did note that the common trend amongst

[32] In the context of this discussion, private investors were generally understood to include venture capitalists and angel investors.
[33] Canadian Foundation for Innovation ("CFI"), "CFI Policy and Program Guide", online: <http://www.innovation.ca/programs/print_content.cfm?websiteid-253>. CFI was created by the federal government as an independent, non-profit organization that supports research by investing in research

most governmental financing agencies is to deny the application of public sector funding to the process of marketing technology post-development.

One Workshop participant presented the Canadian Space Agency as an example of a public/private phased funding scheme. The Canadian Space Agency funds research according to technology readiness levels ("TLRs").[34] At a low technology readiness level, a certain amount of funding is granted. Then, as TLRs increase, the structure of the funding contract changes and industry input increases. One drawback of this method is that industry ultimately decides which ideas are feasible. Workshop participants noted that while the TRL model can be successful for a centralized agency it may be less successful in other fields, such as biotechnology.

The nature of an invention may play a role in determining the appropriate funding mechanism. Workshop participants recognized that the unique attributes of the biotechnology sector and the IT sector illustrate the fact that multiple funding programs might be necessary. For instance, there is a marked difference in the amount of time that it takes to achieve a return upon an investment in IT versus an investment made in biotechnology. It can take many years for a biotechnology project to culminate into a commercial product, whereas an IT product may move from the initial development stage to the marketplace in a matter of months. In order to adequately satisfy the needs of investors in each sector a single funding model may not be successful. The nature of a technology, including factors such as the average duration of research and development, should be taken into account in any funding program.

b) Consolidated venture capital

A second financing problem identified by the Workshop participants was the inconsistency of available funding: it tends to arrive in dribs and drabs. In particular, Workshop participants examined the models of venture capital and angel investors.

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infrastructure. Investment decisions are made by a board of directors drawn from academic communities and the private sector. The assessment criteria applied includes the quality of research and the need for infrastructure, contribution to strengthening the capacity for innovation and the potential benefit of the research of Canada. The CFI requires a Strategic Research Plan where institutions set their priorities based on their strategic vision.

[34] Canadian Space Agency ("CSA"), "Space Technology Development Program", online: CSA <http://www.space.gc.ca/asc/eng/csa_sectors/technology/development/industry/programs/stdp/rfp_2003.asp>.

Statistics produced by Canada's Venture Capital and Private Equity Association ("CVCA") show that in 2003, the amount of money supplied by venture investors in Canada declined from $2.5 billion dollars to $1.5 billion dollars, while the number of companies financed remained constant.[35] In 2002, 88% of disbursements went to technology development but this decreased in 2004 to 81%. According to Dr. Louis, President of the CVCA, "The Canadian venture capital industry supports proportionally more earlier-stage companies than the US; however, financing is much smaller in the US."[36] As noted by Paul Martin in a speech to BIOTECanada given in September, 2003, "Canadian venture capital has succeeded in supporting solid, early-stage ventures, but it has too often failed to convert them through later stages of funding and growth relative to global leaders. As a result, Canada's middle market biotechnology companies are significantly underfunded compared to their global peers."[37]

Workshop participants suggested that presently there are too many small venture capital companies. Too often individual venture capital firms are limited in the financial support that they can offer to a technology project, thus leading to too little money having to be sought too often. Consolidation of existing venture capital companies may increase the amount of capital available and ameliorate innovation financing concerns.

c) Match-making

Workshop participants considered whether matching a start-up company with a larger company would result in better financial support for Canadian researchers. Companies could be matched with either large Canadian companies or international companies in accordance with the strategic policy framework of Recommendation #2. As noted by Workshop participants, matchmaking can be a useful tool because while helping to fund smaller companies, larger companies can simultaneously provide guidance. This guidance can be key to the successful development of a technology.

Examples of this type of matched relationship between industry and researchers exist. For example, although the National Research Council's Industrial Research

[35] Canada's Venture Capital Association, News Release, "Canada's Venture Capital Industry in 2003: A Challenging Year" (17 February 2004).
[36] *Ibid.* In 2003, 51% of investment was dedicated to early stage companies.
[37] Paul Martin, "Building the 21st Century Economy", (Transcript of Speech given to the Board of Trade of Metropolitan Montreal, Montreal, Quebec, Canada, September, 2003), online: BIOTECanada <http://www.biotech.ca/EN/nrSept1803.htm>.

Assistance Program ("IRAP") does not match companies, it provides both financial assistance and business advice to small and mid-size companies ("SMEs").[38] IRAP also maintains a network of important organizations that participate in Canada's innovation system to the benefit of SMEs. This network could be utilized to improve financing of Canadian technology.

d) Collaborative model

Workshop participants recognized the growing trend of conducting research projects, especially in the biotechnology field, through consortia of multiple industry actors and universities. Essentially, industry supplies funding and starting knowledge and technology that enables academics to pursue research and development initiatives. This model has many precedents. Workshop participants pointed to the Networks of Centres of Excellence as examples of the collaborative model in application.[39] Some provisions of the BDA also create a strong incentive for university-industry research collaboration. Furthermore, the general experience of OECD countries has been that collaborative models, or consortiums, can positively impact technology financing.[40] The investment that industry makes in research, and the fact that the financing it provides will support an entire research project, creates a strong bond between the industry investor and the researcher. Intermittent venture capital funding does not necessarily foster this bond. Moreover, the collaborative model focuses the efforts of all involved parties upon an innovative project, thereby facilitating a smooth and rapid transfer of information.[41]

A variety of organizations promote collaborative models. For example, the National Research Council of Canada ("NRC") builds technology clusters. As defined by the NRC, technology clusters involve a significant concentration of innovative companies around a nucleus of research and development facilities. According to the NRC, these

[38] National Research Council of Canada, Industrial Research Assistance Program ("IRAP"), online: IRAP <http://irap-paro.nrc-cnrc.gc.ca/english/howirapcanhelpyou_e.html>.
[39] Networks Centres of Excellence ("NCE"), online: NCE <http://www.nce.gc.ca>. The NCE program is a federal initiative intended to foster partnerships that integrate parties from university, government and industry. According to the NCE website, each NCE that is funded by the program will be designed in a manner that will aim to "develop Canada's economy and improve the quality of life of Canadians."
[40] Organisation for Economic Co-operation and Development ("OECD"), "Science, Technology and Innovation in the New Economy" (2000) OECD Observer, online: OECD <http://www.oecd.org/dataoecd/3/48/1918259.pdf>, at 10.
[41] The Quebec Policy, *supra* note 11 at 94.

clusters stimulate the emergence of new firms, jobs, exports and investment growth.[42] IRAP, working under the auspices of the NRC, also facilitates the formation of technology clusters in Atlantic Canada in the field of ocean engineering.

Another example of collaboration that was highlighted by Workshop participants is the University of Waterloo's cooperative program.[43] Under Policy 73 of the University of Waterloo's intellectual property policy, intellectual property rights are subject to an executed contractual agreement. However, should intellectual property rights be granted to private industry, the industry party to the contract must in turn ensure that academics be able to derive a benefit from any intellectual property created through collaboration. Essentially a trade-off of advantages is ensured. Industry gains intellectual property rights, whereas academics involved in collaborative research are granted the rights to disseminate knowledge gleaned from the project by way of an academic research paper.[44]

Workshop participants did warn that large collaborations involving many parties could cause contract negotiations to become inefficient and costly. Furthermore, some participants were concerned that industry's powerful bargaining position could have a negative impact upon university autonomy to develop technology.

iii. The need for an expert group to study financing needs

Workshop participants concluded that an expert panel should be put together for the purpose of examining technology financing concerns. It was determined that the panel should review the suggestions raised by the participants and conduct relevant studies. The CIPP agreed to organize such a panel.

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[42] National Research Council of Canada ("NRC"), online: NRC <http://www.nrc-cnrc.gc.ca/doingbusiness/clusters_e.html>.
[43] *Supra*, note 30.
[44] It is crucial that any academic exercising his or her right to derive a benefit from the knowledge gleaned from a project through dissemination is wary of putting the potential right to patent or any other form of intellectual property protection in jeopardy through their chosen mode of disclosure. Disclosure rules of the patent regime in particular are strict and can prohibit the patenting of an invention, or even render an issued patent invalid. See Recommendation #4 - Universities and TTOs for further discussion.

RECOMMENDATION #4:

That universities develop internal training strategies for researchers and technology transfer officers to educate them with respect to intellectual property laws and the management of intellectual property and knowledge.

Workshop participants recognized that researchers and TTOs might not be sufficiently educated regarding relevant intellectual property law and management issues. The present lack of training for researchers and TTOs was considered to represent an impediment to technology transfer.[45] Workshop participants also noted that insufficient communication between industry and universities further hinders technology and knowledge transfer. To remedy these problems, Workshop participants determined that the development of a strategy encompassing education and fostering increased communication between universities and industry must be a top priority.

Participants expressed concern that TTOs across Canada suffer from several problems. These problems include: lack of a business mindset and entrepreneurial spirit; lack of a clearly defined purpose, set of goals and objectives; lack of management skills and failure to use outside sources; lack of accountability to researchers, funding agencies and industry partners; and lack of appropriate education regarding intellectual property law, intellectual property ownership and ethical concerns. Often TTOs are wearing multiple hats at one time and it can be unclear in whose interests they are acting.

[45] Participants generally recognized that TTOs need better funding and agreed that the provision of financing should be a priority for universities. Some participants suggested that TTOs could use outside resources to assist them in their tasks. For example, industry partners with an interest in a university's intellectual property could possibly play a greater role in intellectual property management, given their business skills and experience. In a situation whereby industry has acquired a significant interest in intellectual property, such as an exclusive license, the TTO could consider letting the industry partner manage the intellectual property. Some participants determined that industry should seek full ownership of intellectual property in select technology sectors. Furthermore, Workshop participants agreed that TTOs could benefit from pro-bono legal advice to increase their knowledge tools.

Consequently, the general consensus of the Workshop participants was that TTOs needed to increase their independence, efficiency and accountability.

i. Researcher Training

Workshop participants agreed that professors and researchers need to be better informed about university intellectual property policies. In particular, issues such as intellectual property ownership, disclosure rules for patent applications and ethical issues should be emphasized. Better education regarding intellectual property issues would provide researchers with the tools necessary to make informed choices as well as facilitate better contract and licensing negotiations.

Some participants noted that TTOs currently provide a level of technology transfer and intellectual property law education to researchers. However, participants commented that the present TTO education focus must be altered slightly as the present form of education has a notable university bias. This university bias is evident in the presentation of the value of intellectual property to researchers. For example, when TTOs teach researchers about the potential value of an innovation often they do not explain the business costs that off-set the product value, such as production or marketing costs. Researchers who have never worked in industry do not immediately factor in the diminishing effect that such costs have on the value of an innovation. Some participants noted that this often leads researchers to over-estimate the value of their inventions.[46]

ii. TTO Training

Some participants noted that TTOs need to be educated about the strategy and goals underlying technology and knowledge transfer. These participants felt that TTO officers often have unreasonable expectations about the value of university inventions and spend too much time negotiating licenses for technologies of marginal value.

The participants holding this view suggested that universities better train TTO officers how to triage innovations coming in their door so as to distinguish between those innovations which can be dealt with through standard agreements and those that need

[46] Valuation of intellectual property is a difficult process that is often inexact on account of the numerous variables that must be considered and weighed. Multiple formulas can be applied to the valuation of intellectual assets and each has inherent flaws which are occasionally augmented by the nature of intellectual assets themselves in that, as has been pointed out by the Licensing Executive Society USA & Canada Inc.: "[t]here are often questions regarding the identification, ownership, separability or

more intensive negotiation. By spending time only on those inventions with a real commercial potential, TTOs can better use their resources, reducing funding pressures on TTOs.

Several participants noted, however, that TTO officers cannot be expected to properly triage inventions unless they know what the strategic goal underlying technology and knowledge transfer is. For example, if the goal of technology and knowledge transfer is to lead to job growth in Canada, TTO officers will then know that they should most often license technology out on a simplified, largely non-exclusive, basis. They could thus devote their time to creating spin-offs and other job producing activities. If, on the other hand, the strategy is to maximize university revenue, then TTO officers should devote their time to the most remunerative inventions and license the rest out on a simplified basis.

iii. Industry - university communication

Workshop participants found that better communication between industry, venture capitalists and universities is required. Specifically, industry needs to be informed regarding the type of research that is underway in university, where the research is taking place and how to locate research projects suitable for commercialization. The Association of University Technology Managers ("AUTM") is an example of an organization attempting to positively influence communication. AUTM takes an active role in setting up conferences with industry for the purpose of opening lines of communication.[47]

The government of Quebec has also improved communication between universities and industry by establishing six liaison and transfer centers ("LTCs") and 23 Centres of Technology Transfer. LTCs work to strengthen links between companies, SMEs and university researchers by bringing stakeholders from the research community and industry together. The Quebec governmental policies have a dual purpose: the policies invite LTCs to focus their activities on efficiently transferring knowledge, know-how and new technologies; and simultaneously establish liaisons between the research

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transferability of these assets." McFarlane, et al., "Valuation of Intellectual Assets" in Licensing Executive Society USA & Canada Inc., *Intellectual Asset Management and Technology Commercialization*.

[47] Associate of University Technology Managers (AUTM), online: AUTM <http://www.autm.net/index_ie.html>.

community and industry. LTCs are further charged with the task of carrying out networking.[48] Workshop participants pointed to a similar federal example as well. IRAP facilitates communication between small and mid-sized Canadian enterprises, and universities through the maintenance of networks that link industry, funding agents, research and development institutions, and TTOs.[49]

[48] *Supra* note 11 at 87.
[49] Industry Research Assistance program, online: IRAP <http://irap-pari.nrc-cnrc.gc.ca/english/main_e.html>.

CONCLUSION

Ideas and discoveries may be the currency of the 21st century, but in order to develop this currency it is crucial that measures be implemented to facilitate the commercialization of ideas and discoveries. In Canada, significant hurdles to the effective transfer of ideas from the research laboratory to the boardroom remain. Four of the most significant barriers to technology transfer are represented by the recommendations established during the Workshop, namely: harmonization of intellectual property policies; setting a guiding framework and model agreements; means of addressing the funding gap; and promotion of intellectual property education within universities and for TTO officers.

While identifying factors that negatively effect technology and knowledge transfer in Canada and drafting the recommendations as to how to remedy these problems, one factor was consistently recognized: there are no quick fix to any of these issues. The Workshop is a good first step to initiate discussion and to brainstorm ways of overcoming the existing hurdles. However, the recommendations formulated at the Workshop are not final remedies. Instead all four recommendations provide a firm foundation for further deliberation. Recommendations #1, #2 and #3, in particular, expressly call for future meetings of expert groups to further review and study the issues raised. Moreover, Recommendation #4 calls for universities to develop training programs, which will involve a collective initiative within the whole of the Canadian academic sector. Thus, each recommendation represents a type of first stepping stone towards the ultimate goal of facilitating effective technology and knowledge transfer in Canada. Many more stones must be placed to achieve this aim.

APPENDICES

Appendix A - LIST OF PARTICIPANTS

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Appendix B - LIST OF QUESTIONS

TECHNOLOGY TRANSFER WORKSHOP
BREAKOUT SESSION #1

Identify 5 or more Recommendations

The goal of this breakout session is to identify 5 or more ***practical*** recommendations that can be ***implemented*** within the next 5 years to assist technology transfer in Canada. Recommendations should be aimed at changes in policy or practice more than at legislative change. They should be addressed to government, granting agencies, researchers, university administrators, tech transfer officers, industry decision-makers, lawyers, and other actors who may be involved in technology transfer.

In identifying recommendations, consider the following concerns:

1) Canadian universities are strapped for cash and look at technology transfer as one method to bring in revenue. This gives rise to a number of questions:
   a. Should technology transfer be viewed as a means to disseminate research or as a source of revenue? Are these compatible or contradictory objectives?
   b. Which licensing practices permit universities to maximize revenue while ensuring that licensees will be willing to develop technology?
   c. Do technology transfer offices have sufficient funding and expertise to accomplish the universities' goals?

2) Government policy increasingly encourages the commercialization of university research as a means of stimulating the economy. This gives rise to a number of questions:
   a. Ought research grants to be tied to indicators such as number of patents held and success in commercialization? Does this have the effect of skewing priorities towards applied rather than foundational research?
   b. Ought granting agencies to impose uniform intellectual property ownership rules on grantees and, indirectly, on their corporate partners? If so, how should these rules be developed?

3) Inventions made at universities, particularly upstream technology, may have many uses downstream. This gives rise to concerns over the method of licensing technology:
   a. How can licensing practices ensure that licensees actually use the technology transferred?
   b. What licensing practices will ensure that new uses of the technology will be developed, particularly when aimed at developing nations or Canada's neglected populations?

4) Increasingly, research is conducted across institutions and between the private and public sector. This gives rise to coordination problems such as the following:
   a. Should consortium arrangements include a standard form intellectual property rights clause that allocates ownership shares?
   b. How should consortia provides third parties with rights to use the technology? Is unanimity required or should one party have the authority to grant licenses?
   c. How should institutions deal with trans-border issues in respect of intellectual property?

5) Researchers who wish to see their work put into practice face a potential conflict of interest. If they become actively involved in transferring their research to industry, they then have a disclosable conflict of interest in peer reviews and other matters, even if they do not retain a financial stake. If they do not involve themselves with the transfer of know-how, etc., they undermine the viability of the transfer. This gives rise to a number of questions as follows:
   a. Is it possible to give researchers who wish to see their work commercialized an option that would avoid conflicts of interest?
   b. Are there means to reduce the administrative burden placed on researchers in respect of technology transfer?
   c. How ought technology transfer policies to take into account researcher preferences and moral positions?

6) Research emanating from universities if often at an embryonic stage. This means that industry often faces high development costs and risk. They also face tight time constraints. At the same time, universities are seeking revenue from the invention. Questions relating to the management of this risk are as follows:
   a. What are the appropriate licensing arrangements that address the risks and costs faced by industry? For example, what is the relative role of exclusive vs. non-exclusive licensing, reach-through claims, and so on?
   b. How can industry secure access to the researchers who developed the technology in order to assist in product development? Will a right of access interfere with academic freedom?
   c. What techniques are available to bridge the difference between the pace of research at universities and the pace needed in industry to get a product to market?

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TECHNOLOGY TRANSFER WORKSHOP
BREAKOUT SESSION #2

Prioritize Recommendations

The goal of this breakout session is to prioritize the recommendations developed in the first breakout session and, in particular, to identify the top 5 among them. Recommendations should be prioritized on the basis of their ease of implementation, their practical effect, the importance of need they address, and the level of consensus around them. While legislative changes can be considered, they are generally to be given lower priority unless your group feels strongly otherwise.

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