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PERSPECTIVES ON TECHNOLOGY TRANSFER

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PERSPECTIVES ON TECHNOLOGY TRANSFER

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by

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Abstract

This thesis examines the policy perspectives related to technology transfer and the resulting implications on scientific research. The study seeks to answer whether domestic and international laws and policies support a developmental perspective towards scientific research and technology transfer. The study finds that while university policies, government policies as well as international treaties aim to achieve the adoption of a "developmental" model for technology transfer, the commercialization of resources or research through interaction with multinational companies does not necessarily lead to better access, products, revenue or increased innovation. On the contrary, it is argued that the "developmental" model makes room for an exploitative one, giving rise to problems in a variety of research situations from academic patenting to biopiracy. This thesis supports an open access model to attain the policy objectives of greater use of research, as well as furthering the goal of "knowledge-sharing."

Keywords:

Academic Patent, Biopiracy, Knowledge sharing, Materials Transfer Agreement, Research, Technology, Technology Transfer

Dedication

To my parents, Dr. N.N Tripathy and Mrs. Radha Tripathy, for reminding me that research is a skill that requires not only planning and patience, also courage and closure.

Mummy Papa, this thesis is a reality because of you!

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This thesis saw the light of day due to the support, love and inspiration of some wonderful individuals that I came across at the University of Western Ontario, Canada.

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It was always very inspirational to be around you all!

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List of Abbreviation

ABS	: Access and Benefit Sharing
AIDS	: Acquired Immuno Deficiency Syndrome
ARV	: Antiretroviral
AUTM	: Association of University Technology Managers
CBD	: United Nation's Convention on Biological Diversity, 1992
CGIAR	: Consultative Group on International Agricultural Research
CITES	: Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRA	: Canada Revenue Agency
CUDOS	: Communalism, Universalism, Disinterestedness, Organised Scepticism
EPO	: European Patent Office
FDI	: Foreign Direct Investment
GATT	: General Agreement on Tariff and Trade
IARCs	: International Agricultural Research Centres
IBRD	: International Bank for Reconstruction and Development
IPR	: Intellectual Property Rights

ITPGRFA	: United Nation's Food and Agriculture Organisation's International Treaty on Plant and Genetic Resources for Food and Agriculture, 2001
LDCs	: Least Developed Countries
MAT	: Mutually Agreed Terms
MIT	: Massachusetts Institute of Technology
MNCs	: Multi National Corporations
MRI	: Ministry of Research and Innovation
MTAs	: Material Transfer Agreements
NGO	: Non Governmental Organisations
NIEO	: New International Economic Order
OMAFRA	: Ontario Ministry of Agriculture, Food and Rural Affairs
ORCP	: Ontario Research and Commercialization Program
PGRs	: Plant Genetic Resources
PIC	: Prior Informed Consent
PSIA	: Public Servants Inventions Act
R&D	: Research and Development
RTLA	: Reach Through License Agreement

SMTA : Standard Material Transfer Agreement

SR&ED : Scientific Research and Experimental Development

TLOs : Technology Liaison Officers

TRIPS : The World Trade Organisation's Agreement on Trade Related aspects of Intellectual Property Rights, 1995

TTOs : Technology Transfer Offices

UN : United Nation Organisation

UNCTAD : United Nation's Conference on Trade and Development

US : United States of America

USPTO : United States Patent and Trademark Office

VCLT : Vienna Convention on the Law of Treaties

WIPO : World Intellectual Property Organisation

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Chapter 1

1. Introduction

> [E]ach generation has been benefitting by the trials and failures of the preceding generation... Step by step the science of mathematics has advanced immensely since the time of Newton. Our modern steam engines and locomotives far surpass those of Watt and Robert Stephenson and so it is with every item which goes to form that which we term our civilization. We have risen, step by step, on the ladders and scaffolds erected by our predecessors.[1]
>
> - Alfred Russel Wallace

This essay by Alfred Russel Wallace reflects the success of human endeavour and its ensuing progress. If mankind were credited for all that has been achieved, there would be much reason for celebration. While that may be a joyful thought, the endeavour that has contributed to the greatness of mankind has undergone an immense transformation. This endeavour is known as "knowledge sharing" which has been a primary factor in human progress. An affirmation of this transformed endeavour is the tale of the San tribe.[2] The San are known to traditionally eat parts of the hoodia plant as an appetite suppressant on their long hunting trips in areas of the Kalahari Desert in Southern Africa. The tribe has lived off the land in a region that includes Botswana, Namibia, South Africa and Angola for several years. With a population of over a hundred thousand people, the

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[1] *See*, A. R. Wallace, *Human Progress: Past and Future 1892* (Boston: Arena, 1892) online: <http://people.wku.edu/charles.smith/wallace/S445.htm > (last accessed on December 11, 2010).

[2] For similar examples *see,* D. F. Robinson, *Confronting Biopiracy – Challenges, Cases and International Debates* (UK: Earthscan, 2010) at 56. ["Robinson"]; *See also*, J. Kuanpoth, "Closing in on Biopiracy; Legal Dilemmas and Opportunities" in R. Melendez-Ortiz and V. Sanchez eds., *Trading in Genes: Development Perspectives on Biotechnology, Trade and Sustainability* (London: Earthscan, 2005) at 139, 152; *See* J. Chen, "There is No Such Thing as Biopiracy...And it's a Good Thing Too" (2006) 37 McGeorge L. Rev 32 for counter-examples.

San tribe is ranked as one of the most impoverished communities in Africa.[3] During the 1990s, scientists of the South African Council for Scientific and Industrial Research (SACSIR) approached the San members to informally discuss the hoodia with them. In 1995, SACSIR filed a patent in South Africa for use of the active components of the hoodia plant, responsible for suppressing appetite. The SACSIR signed an exclusive licensing agreement with a British company, Phytopharm, and also filed for additional patents in other countries, earning lucrative royalty payments and license fees.[4] The SACSIR did not consult the San tribe to obtain their informed consent prior to developing, patenting and commercialising hoodia. No attempt to establish any sort of benefit-sharing arrangement was made. The publicity of the returns generated due to the patents on the hoodia plant led other herbal supplement companies to start collecting the plant excessively. By 2006, trade in the hoodia-related products had escalated exponentially – in many cases illegally – from just a few tonnes to more than 600 tonnes of wet, harvested material per year, sold as ground powder for incorporation into non-patented dietary supplements. Wynberg notes:

> [I]n North America in particular, dozens of hoodia products were sold as diet bars, pills, drinks and juice, traded by a myriad of companies 'free riding' on the publicity and clinical trials of Phytopharm.[5]

Threatened by the unregulated harvest from its natural environment, in 2004 hoodia was included in the Appendix of the Convention on International Trade in

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[3] *See,* K. Bavikatte, H. Jonas and J. Von Braun, "Shifting Sands of ABS Best Practice: Hoodia from the Community Perspective," in *UNU-IAS Traditional Knowledge Initiative: Guest Articles* (Japan: UNU-IAS, 2009) at 87. ["Bavikatte *et al*"].

[4] *See*, R. Wynberg, "Access and Benefit-Sharing Agreements in the Commercial Development of Hoodia" in S. Laird and R. Wynberg eds., *Access and Benefit-sharing in Practice: Trends in Partnerships Across Sectors* (Montreal: Technical Series No 38, CBD Secretariat, 2008a) at 33. ["Wynberg"] for similar discussion.

[5] *Supra* note 4 at 83.

Endangered Species of Wild Fauna and Flora (CITES) in order to restrict the international trade in hoodia to licensed companies.

Examples of similar unauthorised access to a resource and related know-how from a country of origin, patenting of the resulting technology, and refusal to acknowledge or share the accrued benefits constitute an abuse of the enterprise of "knowledge sharing."

Without a doubt, mankind has been able to develop because of its ability to reason. From time immemorial, ingenuity and ideas emanating from the human mind have been shaping the future of the human race.[6] This rapid development of mankind would have been unattainable had it not been for sharing knowledge around the globe. Many civilizations in human history have necessarily passed on new ideas, culture and technology. From the horse cart to jet planes, it is this growth in science and technological innovation that is an indicator of human progress. With scientific progress, the speed at which technology evolved into more sophisticated and useful forms accelerated the need of bringing the technology from the creator to the market where the consumer could use it, giving rise to a formal system of technology transfer. Thus began the commercialization of science and technology.

Legal devices such as intellectual property rights grant inventors a limited monopoly right to exclusively use and commercialize technology. Since the invention is not in the public domain, the permission of the inventor must be sought by means of licensing, contracts and the like. Private ownership of technology led to technology

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[6] *See* for example, L. Fredholm, "The Discovery of the Molecular Structure of DNA – The Double Helix" online: http://nobelprize.org/educational_games/medicine/dna_double_helix/readmore.html (last accessed on February 11, 2011) for discussion regarding the discovery of the double helix structure of the de-oxyribose nucleic acid by James Watson and Francis Crick in 1953.

transfer becoming a multibillion dollar industry.[7] With technological innovation becoming a property, the need for regulating its commercialization and transfer surfaced and new regulatory measures and policies at the domestic and international level emerged.

1.1 Historical Account of Technology Transfer

G.K Manning explains:

> [F]ew expressions represent so many different meanings to so many different people as the often-used phrase 'technology transfer.'[8]

A further review of the literature pertaining to these diverse perspectives is presented to establish that there is an absence of a model aimed at extracting basic resources for research and transferring technology. While presenting two parallel strands of observation from the literature, it is found that the main participants engaged in technology transfer activities, and the definition of that activity, have evolved over time. Well-known examples such as the Venetian attempts to acquire the secret of Greek fire from the Byzantine navy during the late Middle Ages,[9] the spread of the printing press across Europe after Gutenberg,[10] or the British struggle to prevent the export of their steam engines and textile machinery, which were core technologies of the industrial

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[7] *See generally*, L. Ritchie de Larena, "The Price of Progress: Are Universities Adding to the Cost" (2007) 43 Houston L. Rev., Part V opening paragraph at 24. ["Ritchie de Larena"]

[8] *See*, G. K Manning, *Technology Transfer: Successes and Failures* (San Francisco: San Francisco Press, 1974) at 54.

[9] *See,* A. Roland, "Secrecy, Technology and War: Greek Fire and the Defense of Byzantium" in *Technology and Culture* (Maryland: The Johns Hopkins University Press, 1992) 655, 679.

[10] *See*, E.L Eisenstein, *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early Modern Europe* (New York: Cambridge University Press, 1980) at 44.

revolution,[11] testify that technology transfer is not a modern concept. The specific historical circumstances which brought increased attention to technology transfer activities were World War II and its aftermath, the end of European colonialism, the Cold War, the dawning of the Space Age and the various technological ages that marked the last half of the twentieth century, and the re-emergence of global economic competition. These circumstances created the context within which technology transfer practitioners have operated and imparted a dynamic dimension to the definition of technology transfer.[12] Human activities such as invention, trade, selling, buying, spying, copying, empire building and military conquest involved the transfer of technology. Academics who have studied technological diffusion have adjusted and extended the concepts of what it takes for nations, firms and organizations to innovate, adopt and adapt technologies developed elsewhere.

The end of World War II left millions devastated, prompting American leaders to propose and initiate aid programs. This resulted in the Marshall Plan, which is described as the most massive technology transfer in history.[13] The success of the Marshall Plan influenced the major historical instance of organized technology transfer, namely the international aid programs for the less-developed countries (LDCs).[14] Western leaders

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[11] *See*, J.R. Harris, *Essays in Industry and Technology in the Eighteenth Century: England and France* (Brookfield, V.T: Ashgate, 1992) at 56.

[12] *See*, B. Seely, "Historical Patterns in the Scholarship of Technology Transfer" in *Comparative Technology Transfer and Society* (New York: The Colorado Institute for Technology Transfer and Implementation, 2003) at 34 ["Seely"].

[13] *See* , A. Ahmad and A.S Wilkie, "Technology Transfer in the New International Economic Order: Options, Obstacles and Dilemmas" in D.S Papp and J. McIntyre eds., *The Political Economy of International Technology Transfer* (New York: Quorum, 1979) at 79. ["Ahmad and Wilkie"]

[14] *See*, ["Seely"] *supra* note 12 at 9, wherein it was noted that "pressure to end European colonial rule in Africa and Asia had grown for decades, but the prostrate condition of European nations encouraged

assumed that the creation of modern economies might be achieved by replicating the Western development patterns, especially its technology.[15] Baark, Elzinga and Bortgstrom have noted that "common to all Western explanations of different patterns of development was the assumption that modernization is essentially European phenomenon and that Asian development must be analyzed with reference to this European experience."[16] Scholars mention that it was during this time that "the vocabulary of modernization theory incorporated pejorative terms such as *underdeveloped* before labels such as *more* or *less* developed, *Third World* and *North-South* came into vogue."[17] International Organizations such as the United Nations (UN) and private foundations such as the Rockefeller Foundations played key roles in transferring Western technology. The UN for instance, initiated the UN Expanded Program of Technical Assistance in 1950 to send experts to over 150 countries and train students. The UN also helped in creating the International Finance Corporation in 1956 having earlier joined with the World Bank to

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nationalist leaders. Britain bowed to the inevitable, granting India and Pakistan independence in 1947 and creating a Dominion that included many new nations in Africa and Asia. When the French, Dutch and especially the Portuguese hesitated, bloody wars of national determination erupted in Algeria, the Congo, Vietnam and elsewhere…but new nations founded with much hope faced daunting economic challenges"; *See* also, ["Ahmad and Wilkie"] *supra* note 13 at 79, wherein it was noted that "these nations soon began to realize that political freedom could not be construed as an end in itself and that achieving it did not automatically ensure the social and economic well-being of their people"; *See* also, J.D Hargreaves, *Decolonization in Africa* (New York: Longman, 1988) at 23; *See* also, M. Zinkin and T. Zinkin, *Britain and India : Requiem for Empire* (Baltimore: The Johns Hopkins University Press, 1964) at 44 wherein it was noted that "new nations [like India] founded with much hope faced daunting economic challenges".

[15] *See* ["Seely"] *supra* note 12 at 9.

[16] *See*, A. Elzinga, B. Bortgstrom and E. Baark, *Technological Change and Cultural Impact on Asia and Europe – A Critical Review of the Western Theoretical Heritage* (Lund, Sweden: Research Policy Institute, University of Lund, 1980) at 1.

[17] *See* for instance ["Ahmad and Wilkie"] *supra* note 13 at 79.

establish the International Bank for Reconstruction and Development (IBRD). In 1960 the two agencies partnered to create the International Development Agency.[18]

It is noteworthy that the common feature of assistance from Foundations, the UN and the World Bank was the assumption that economic development required the transfer of advanced Western technology. Technology transfer emerged as an essential tool for furthering innovation, foreign aid and economic development by means of capacity building. Having reiterated that scholarly interest with the concept of technology transfer is uncommon, the ensuing section discusses the outline of this thesis.

1.2 The Present Study: Aims, Scope and Structure

1.2.1 Aims of the Study

This study aims to identify the emerging models of scientific research and technology transfer, the conflicts and synergies between profit-making and conservation of basic resources, and to arrive at an understanding of the approaches and consequences of commercialization and patenting of basic science and technology at the domestic and international levels.

The legislative purpose of domestic laws and policies in developed countries such as United States of America (US) and Canada, as well as the international regulatory framework relating to technology transfer, favours better access, products, revenue or

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[18] *See*, W.A Brown Jr and R Opie, *American Foreign Assistance* (Washington, DC: The Brookings Institution, 1953) 399,406; *See* also, P.G Hoffman, *World Without Want* (New York: Harper & Row, 1962) 114,115; *See* also, G. Rosen, *Western Economists and Eastern Societies: Agents of Change in South Asia, 1950-1970* (Baltimore: The Johns Hopkins University Press, 1985) at 45; *See* also, United Nations Technical Assistance Board, *15 Years and 150,000 Skills : An Anniversary Review of the United Nations Expanded Programme of Technical Assistance* (New York: United Nations Economic and Social Council, 1965).

increased innovation. This perspective is labelled as the "developmental" model. However, in order to implement the domestic laws, policies and international regulations, increased interaction with private industry is required, making way for a new perspective. The perspective of the private industry is labelled as the "corporate" model. **The central claim of the study is that, inherent in the "developmental" model for scientific research and technology transfer is the "corporate" model which gives rise to problems in a variety of research situations from academic patenting at the micro level to biopiracy at the macro level of policy making.**

Generally, this study aims to provide an answer to the main question: whether laws and policies pertaining to technology transfer at the domestic and international level support a "developmental" perspective towards scientific research and technology transfer? Furthermore, this study also aims to provide answers for the following questions: First, what are the implications of excessive commercialization of science and technology on the traditional enterprise of "knowledge sharing"? And second, does the "corporate" model transform the traditional enterprise of "knowledge sharing" into an exploitative one at the domestic as well as the international level?

The analysis begins with a discussion of the theoretical model of optimum scientific production and leads to examination of laws and regulations related to the commercialization of science and technology at the micro and macro level of policy making. The conflicts pertaining to the goals of commercialization of scientific research and technology transfer in the World Trade Organisation's Agreement on Trade Related aspects of Intellectual Property Rights, 1995 (TRIPS) and the conservation of resources essential for scientific research and technological development hailed in the United

Nation's Convention on Biological Diversity, 1992 (CBD) are examined. The TRIPS Agreement is the framework treaty determinative of international policy making regarding commercialization of scientific research and technology transfer. Hence, the interpretative analysis of the provisions pertaining to technology transfer in TRIPS will prove the presence of a "developmental" model at the international level in principle. The study will further analyze the technology transfer provisions in CBD *in relation to* TRIPS to argue that the "developmental" model in essence is a "corporate" model making room for exploitation in research scenarios.

1.2.2 Limitation of the Study

The scope of the study is limited to the policy approaches pertaining to technology transfer in the developed countries of US and Canada at the domestic level and the TRIPS and CBD at the international treaty framework. Regional approaches such as North American Free Trade Agreement (NAFTA) and arrangements within private international law are not discussed in this study.

1.2.3 Structure of the Study

The thesis is divided into five chapters. Chapter 1 introduces the subject matter and the historical account of the phenomenon of technology transfer. The chapter also describes the aims, scope and the structure of this study. Chapter 2 discusses various definitions, concepts and processes pertaining to technology transfer available in the literature. Chapter 3 describes the theories of optimal scientific production to highlight the norm of "communalism" and the prevalent policy models for commercialization of scientific research and development in the developed countries of US and Canada so as to comprehend the domestic approach to technology transfer. Chapter 4 examines the

provisions pertaining to technology transfer in TRIPS and the CBD to note the presence of a "corporate" model within the "developmental" model in the international regulatory framework. Chapter 5 is the conclusion describing the findings in terms of the issues and existing conflicts between the parties at the domestic and international level. Suggestions to adopt an "open access" model instead of total privatization of scientific research are made. The newly adopted multilateral system under the United Nation's Food and Agriculture Organisation's International Treaty on Plant and Genetic Resources for Food and Agriculture, 2001 (ITPGRFA) is cited as an example of a positive start at the international level to further the public interest in terms of conservation of resources for future scientific research and the goal of "knowledge sharing."

Chapter 2

2. Conceptual Nuances of Technology Transfer

> [T]echnology discloses the active relation of man towards nature, as well as the direct process of production of his very life, and thereby the processes of production of his basic societal relations, of his own mentality, and his images of society, too.[19]
>
> - Karl Marx

Marx's definition of technology signifies the social relevance of its relation with man's development. This chapter explains the concepts and meanings of the essential terms related to the process of transferring technology.

2.1 Technology transfer: Definitional concerns

The term technology transfer has been used to denote a very wide range of activities. Part of the ambiguity associated with it stems from the term "technology." Therefore, before delving into the conceptual nuances of technology transfer, it is imperative to define what is meant by "technology."

2.2 What is technology?

Eminent scholars have grappled with the difficulty of defining the term "technology."[20] The traditional perception of technology which originated with Aristotle and is still held by many philosophers is the view that "technology is a human arrangement of techniques – tools, machines, instruments, materials, sciences and

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[19] K. Marx, "Machinery and Big Industry" in *Das Kapital* (New York: Regnery Publishing Inc, 1967) at 35.

[20] *See*, G. A Klein, and B. Crandall, "Finding and Using Technology-Specific Expertise" (1991) 16 JTT at 23; *See* also, J. Rogers, and B. Bozeman, "Basic Research and Technology Transfer in Federal Laboratories" (1997) 22 JTT at 37.

personnel – to make possible and serve the attainment of human ends."[21] Barry Bozeman laments that unlike circumstances in which definitional difficulties can be quickly resolved by simply relying on the dictionary, the term technology poses a unique problem.[22] The definitions of technology provided by the Webster Dictionary,[23] do not offer respite in setting the definitional difficulties to rest. According to the dictionary, technology is defined as "the science or study of the practical industrial arts," "the terms used in a science, technical terminology," "applied science," "a method, process, *et cetera* for handling a specific technical problem," and "the system by which a society provides its members with those things needed or desired."[24] While this definition may serve as a starting point, study of technology requires a fundamental meaning. For instance technology also includes "the skills, knowledge and procedures for making, using and doing useful things,"[25] or "the means and capacity to perform a particular activity."[26] In its commercial context, technology is taken to embrace the "knowledge of how to make

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[21] *See*, C. Singer, "L.T Hobhouse Memorial Trust Lecture No. 21," in *Technology and History* (London: Oxford University Press, 1952) at 19, noting that "...the essence of history is no politics but technology..." ["Charles Singer"]; *See* also, J.W Cohen, "Technology and Philosophy" (1955) 3 Colarado Quarterly at 4.

[22] *See*, B. Bozeman, "Technology Transfer and Public Policy: A Review of Research and Theory" (2000) 29 Research Policy 627. ["Barry Bozeman"].

[23] *See,* D. Guralnik ed, *Webster's New World Dictionary,* 2ed., (Toronto, Canada: Nelson, Foster and Scott Ltd, 1970) at 1460. ["Webster"].

[24] *See*, ["Webster"] *supra* note 23 at 1460; *see* also, P. Speser, "The Game of Technology Transfer" in *Art and Science of Technology Transfer* (Canada : John Wiley & Sons, 2006) at 10, for discussion regarding application of technology transfer in a day to day scenario such as having cereal for breakfast.

[25] *See,* R. S Merril, "The Study of Technology," in D.L. Sills, ed., *Encyclopaedia of Social Sciences (1968), quoted in* UNITAR Res Report, no. 14 (1971) 3.

[26] *See*, W.H Gruber and D.G. Marquis, "Research on the Human Mind" in *Factors in the Transfer of Technology* (Cambridge, Mass: M.I.T. Press, 1969) at 255.

use of factors of production to produce goods or services for which there is an economic demand."[27]

Bozeman mentions "works on technology transfer generally focus on technology as an entity or a tool, not a study and certainly not any specific applied science."[28] Notable theorist Devendra Sahal presents an alternative to the dictionary meaning of technology and the confusion owing to poorly specified concepts, by observing "these products, processes and configurations are not useful without knowledge of their applications."[29] Sahal's notion of technology supports the view that without that knowledge base the physical entity cannot be put to use. The knowledge base is inherent, not ancillary to technology.[30] Thus, the definitions of technology do no more than to describe one or more of the combinations of skills or rights embodied within the notion. Reference is made to whether it is embodied in a tangible form such as in plant, machinery, or skilled labour; whether it is intangible such as managerial knowledge and technical skills; or to whether it is enshrined in legal documents such as patent licenses, know-how agreements or registered designs. The quantum of knowledge, he explains,

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[27] *See*, A. Brown, "Impact of Patents and Licenses on the Transfer of Technology" in S. Gee, ed., *Technology Transfer in Industries Countries* (New York: John Wiley & Sons Inc, 1979) at 311.

[28] *See*, ["Barry Bozeman"] *supra* note 22 at 628; *See* also, J. K. Fiebleman, "Pure Science, Applied Science, Technology, Engineering: An Attempt at Definitions" (1961) 2 Technology and Culture 305, noting that "...[B]y pure science or basic research is meant a method of investigating nature by the experimental method in an attempt to satisfy the need to know. By applied science is meant the use of pure science for some practical human purpose. Thus science serves two human purposes: to know and to do..."

[29] *See*, D. Sahal, "Alternative conceptions of technology" (1981) 10 Research Policy at 2. ["Devendra Sahal"].

[30] *See* ["Charles Singer"] *supra* note 21 at 629; *See* also, E.W Hayden, *Technology Transfer to East Europe: US Corporate Experience* (New York: Praeger, 1976) at 23 for another example.

"comprises two parts: the engineering documentation and the manufacturing techniques."[31]

In the international realm, the working definition of technology is that employed in the Licensing Guide for Developing Countries, produced by the World Intellectual Property Organisation ("WIPO"):

> Technology is the systematic knowledge for product manufacture and service provision in industry, farming and commercial fields. Knowledge is reflected in inventions, utility models, designs, and in data forms. Knowledge is also shown in industrial plants, design, installation, operation, and equipment maintenance, management of industrial & commercial corporations, the technical skill and experience of experts for those activities.[32]

In this definition, it must be noted that technology *is* knowledge. However, not all knowledge is included. That is, knowledge must be transferable and it must be systematic so as to satisfy needs and problems that arise in special fields of human activity including industry, farming and commerce. So, there are three standards in the definition of technology as per the WIPO. First, knowledge must be systematic. This means that it must be organized in terms of providing solutions to problems. Second, knowledge must exist in certain places like in someone's head or in documents, and must be able to be presented, so no matter what it means it must be able to be transferred from one person to another. Third, it must be oriented towards purpose, so that it can be utilized in industry, farming and commercial fields. This definition highlights the importance of technology to all stages of a commercial or industrial endeavour. Thus technology has a role to play in the definition of a need, the evaluation of relevant technical solutions, design work and

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[31] *Ibid.*

[32] *See*, WIPO, *Licensing Guide for Developing Countries* (Geneva: WIPO, 1977) at 28.

the installation, operation and maintenance of the appropriate technical solution essential for the need which has been defined. This study refers to the term technology as the application of scientific knowledge or research. That is to say, technology is the use of scientific knowledge by a given society at a given moment to resolve concrete problems facing its development. It would be, thus erroneous to limit the description of technology to only the device[33] or process or configuration[34] or just the knowledge of the construct's applications, while adopting a study on transfer of technology especially since today technology transfer is not limited to the local boundaries but has become an international phenomenon. The problem with limiting the description of technology to such strict applications leads to several assumptions. For instance, it is often assumed that if a machine or a technique of production works perfectly well in the country and circumstances in which it was created and nurtured, it ought to do just fine in any other locale when transferred.[35] This is however not true in all circumstances as it depends on the recipient country's capacity to absorb the technology.

Figure 1 describes the attributes of technology. Technology emanates from scientific knowledge or research that is then applied and fixed in a material form such as a document or device. It is for the purpose of problem solving and is afforded legal protection from misappropriation. Technology most importantly must be transferable and accessible to the user. The transfer of technology may be facilitated by direct or indirect

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[33] *See* ["Charles Singer"] *supra* note 21 at 5, noting that "...[A] high tech example of technology is a cancer detection probe, comprised of sensing devices that detect responses in tissues to specific wavelengths of light and electrical impulses, and of a computer system that transfers and interprets the signals, and relates them to tissue types."

[34] *See* ["Devendra Sahal"] *supra* note 29 at 4.

[35] *See*, A. I. Akubue, "Technological Capabilities and Industrialization" (1990) 2 JTS 15.

means. Direct technology transfer refers to specific technologies being transferred by means of visible channels such as contract or cooperative research projects. Indirect technology transfer concerns knowledge exchanged through informal meetings, seminars, publications or workshops.

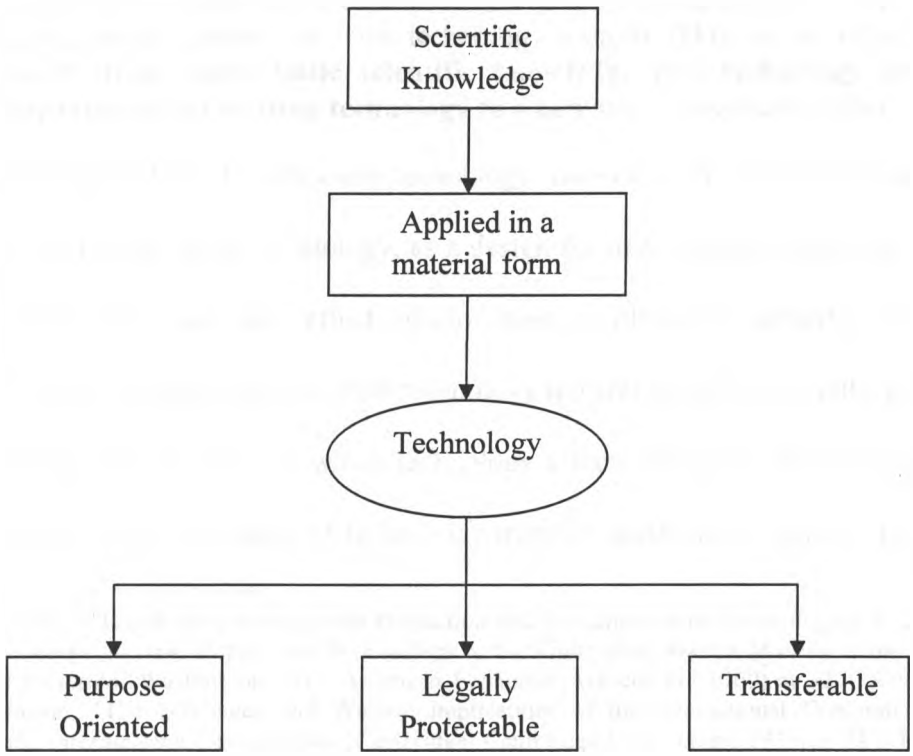

Figure 1: Attributes of Technology

2.3 What is technology transfer?

Technology transfer is defined in many different ways, sometimes according to the discipline of the research, and also according to the purpose of the research. For instance, economists tend to define technology transfer on the basis of "the properties of

generic knowledge,"[36] focusing particularly on "variables that relate to production and design."[37] H. Brooks[38] has presented a generalised economic perspective of the term technology transfer by describing it as:

> [T]he process by which science and technology are diffused throughout human activity. Wherever systematic rational knowledge developed by one group or institution is embodied in a way of doing things by other institutions or groups, we have technology transfer. This can be either transfer **from more basic scientific knowledge into technology or adaptation of an existing technology to a new use**.[39] [*emphasis added*]

Sociologists tend to associate technology transfer with innovation and view technology, including social technology, as a design for instrumental action that reduces the uncertainty of cause and effect relationships involved in achieving a desired outcome.[40] Anthropologists tend to view technology transfer broadly within the context of cultural change and the ways in which technology affects change,[41] while management scholars tend to focus on stages of technology transfer, particularly relating design and

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[36] *See*, K. Arrow, "Classificatory notes on the Production and Transmission of Technological Knowledge," *American Economic Review, Papers and Proceedings of the Eighty-first Annual Meeting of the American Economic Association* (Washington, D.C: American Economic Association, 1969) at 32. ["Arrow"]; *See* also, H. Johnson, "The Efficiency and Welfare Implications of the International Corporation" in C. Kindleger, ed., *International Corporations* (Cambridge: Cambridge Univ. Press, 1970) at 24 ["Johnson"]; *See* also, G. Dosi, "The Nature of the Innovation Process," in G. Dosi, *et al.* eds., *Technical Change and Economic Theory* (London: Pinter Publishers, 1988) at 22 ["Dosi"].

[37] *See* also, C. Freeman and L. Soete, *The Economics of Industrial Innovation,* 3rd ed (London: Washington Printer, 1997) at 15.

[38] *See*, H. Brooks, "National Science Policy and Technology Transfer," Proceedings of a Conference on Technology Transfer and Innovation, National Science Foundation Publication No. NSF (Washington D.C: National Science Foundation, 1966).

[39] *Ibid.*

[40] *See*, E.M. Rogers, *Diffusion of Innovations* (New York: The Free Press of Glencoe, 1962); *See* also, E.M. Rogers, F. F. Shoemaker, *Communication of Innovations: A Cross Cultural Approach* (New York: Free Press, 1971).

[41] *See*, G.M. Foster, *Traditional Cultures and the Impact of Technological Change* (New York: Harper Publishing, 1962) at 20; *See also*, R. Merrill, "The Role of Technology in Cultural Evolution" in *Social Biology* (Chicago: University of Chicago Press, 1972) at 246.

production stages, as well as sales, to transfer.[42] J. D. Roessner,[43] an eminent policy maker, defines the concept as "the movement of know-how, technical knowledge, or technology from one organizational setting to another." He notes:

> The term has been used to describe and analyze an astonishingly wide range of organizational and institutional interactions involving some form of technology-related exchange. 'Sources' of technology have included private firms, government agencies, government laboratories, universities, non-profit research organizations, and even entire nations; 'users' have included schools, police and fire departments, small businesses, legislatures, cities, states and nations. Within single organizations such as large, research-intensive private firms, technology transfer has been used to describe the processes by which ideas, proofs-of concept, and prototypes move from research-related to production-related phases of product development.[44]

It is clear that the existing literature on technology transfer describes the movement of applied scientific knowledge between various institutions. Transferring the technology created in the laboratory to someone who may be able to use and build on it is typically referred to as technology transfer. Technology transfer is necessary because any idea, no matter how innovative or merely conceived and maintained in the brain, will have no value until the idea is transferred to a user. Some literature refers to the same process as 'knowledge transfer.'[45] Scholars also note that innovation may be thought of as

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[42] *See*, D. Teece, "Technology Transfer by Multinational Firms: The Resource Cost of Transferring Technological Know-How" (1977) The Economic Journal 242 at 245; *See* also, A. Lake, "Technology Creation and Technology Transfer by Multinational Firms" in *Research in International Business and Finance* (Greenwich: Jai Press, 1979) at 137.

[43] *See*, J.D. Roessner, "Technology Transfer" *in press*, C. Hill,.ed.,in *Science and Technology Policy in the US, A Time of Change,* (London: Longman, 1993) ["Roessner"]; *See* also, H. Norman Abramson, *et al, Technology Transfer Systems in the United States and the Germany, Lessons and Perspectives* (Washington : National Academy Press, 1997) for a comprehensive definition of technology transfer processes in the United States and Germany.

[44] *See* ["Roessner"] *supra* note 43 at 1.

[45] *See*, L. Argote and P. Ingram, "Knowledge Transfer: A Basis for Competitive Advantage in Firm" in *Organization Behaviour and Human Decision Processes* (London: Artech House Inc, 2000) at 150.

the whole process from idea to finished product while technology transfer is the means of achieving innovation.[46] According to Lazar Sarna:

> Technology transfer is merely part of the commercialization process and refers to the process of transferring intellectual property whether or not it is fully developed or subject to protection from the inventor to a commercial agent, or any other party on the road to commercialization.[47]

Therefore technology transfer has involved the commercialization of scientific knowledge for transferring technology from the originator to the consumer for income generation.

2.4 Commercialization of publicly funded R&D: A multidimensional process

The process of technology transfer is a multi-dimensional process, involving science, business and law. Figure 2 from a university hospital model in Canada is an illustration explaining the interrelationship in that environment. The process of technology transfer begins from the time of the disclosure of the invention at the time of filing for a patent. While the patenting procedure is underway, evaluation of the invention's market potential begins in order to ascertain if it is marketable and at what scale. Research organizations may not be able to carry out such an evaluation, and without aid they then try to license the invention to a business corporation or start a spinoff company. A patent, if the invention passes the examination process, will give the owner full control over the invention. After the patent approval, if the invention is licensed, the owner receives the royalties from the licensee. If, on the other hand, a spin-

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[46] *See,* I. Cooke and P. Mayes, *Introduction to Innovation and Technology Transfer* (London: Artech House Inc, 1996) at 27.

[47] *See,* L. Sarna, *Commercializing Research and Development: A Guide to Legal and Business Practice* (Canada: LexisNexis Butterworths, 2006) at 5.

off company is established, then a business plan is developed to market that invention and the owner may get the revenue from the sale of that invention.

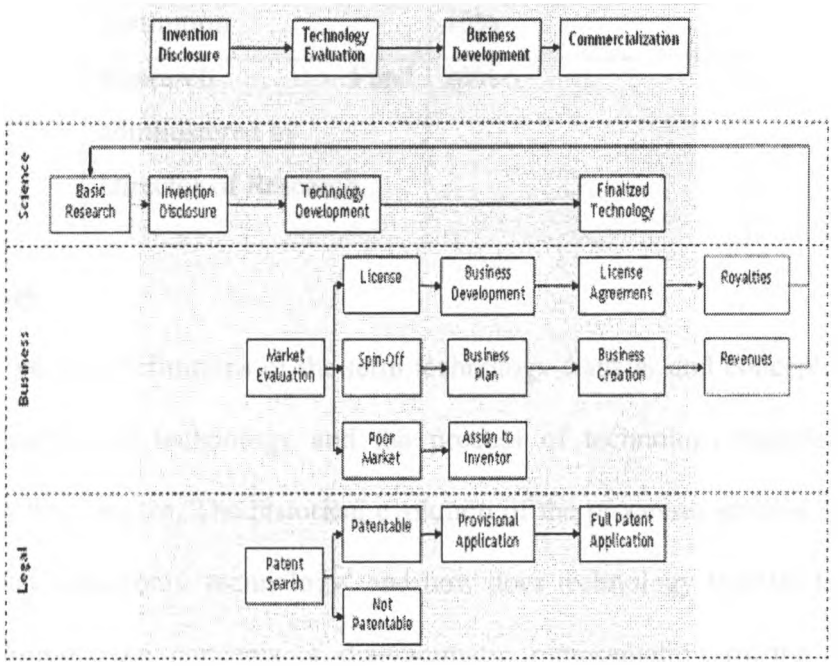

Figure 2: The Multidimensional Process of Technology Transfer[48]

Percentage of the royalties and the revenue are usually reinvested in research and further innovation and development. For instance, the net revenue generated in Mount Sinai, that is, the revenues received less the expenses incurred in seeking protection, further development and commercialization of the invention, is shared in the ratio represented in Table 1.

[48] The copyright of the table vests with Mount Sinai Hospital, Ontario Canada, available on file with the author, with thanks to Deepshikha Dutt, LLM, University of Western Ontario.

Table 1: Revenue Sharing Policy of Mount Sinai Hospital, Ontario, Canada[49]

Party	Percentage of Revenue
Inventor(s)	40%
Institution	40%
Research Fund administered by Director of Research	20%

2.5 Summary

The various definitions of the term technology transfer and concepts interlinking commercialisation of technology and the process of technology transfer have been presented in this chapter. The historical evolution of the processes involve difficulties in defining what constitutes 'technology' and how does technology transfer take place. In order to simplify the concepts, a diagrammatic representation of the attributes of technology is presented in Figure 1. This study defines technology as the result of application of scientific knowledge and research fixed in a medium, which is capable of problem solving and should be legally protectable and accessible to the end-user. Figure 2 from a University Hospital model illustrates the multidimensional process of technology transfer. Having clarified the concepts related to technology transfer, the following chapters discuss particular implications of commercialising basic science and research.

[49] Email correspondence dated July 04, 2011 with Terry Donaghue, Director, Technology Transfer and Industry Liaison, Mount Sinai Hospital Foundation, Ontario, Canada.

Chapter 3

3. Technology Transfer: A Domestic Outlook

> [F]or years a battle has been raging in the courts over expanding versus constricting patent protection. Universities have generally entered the list with entrepreneurial firms in advocating broader protection, and hence greater value for their own [intellectual property]. When money is on the table, it seems, universities take a narrow view of the public interest. Most universities define the mission of technology transfer in language that highlights benefits to society. However, social benefits or the public good can be slippery terms, subject to many interpretations.[50]
>
> - R. Geiger and C. Sa

The 1970s to 1990s witnessed significant growth in patenting, licensing and start up company formation by public sector institutions in the US.[51] Several survey studies by Statistics Canada in the year 2003 showed a similar trend in Canada albeit on a smaller scale.[52] Historically, knowledge generated within universities was transferred to the outside, including to industry.[53] Informal knowledge transfers are reportedly the outputs from universities most highly valued by industry.[54] Studies further account that scientists

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[50] *See*, R. Geiger and C. Sa, *Tapping the Riches of Science: Universities and the Promise of Economic Growth* (Cambridge, MA: Harvard University Press, 2008) at 146 (the authors opine that "traditionally, much of the knowledge left the university environment with the graduation of students, in publications and in conference presentations of faculty.") ["Geiger and C. Sa"]

[51] *See* for instance, D.C Mowery *et al.*, "The Growth of Patenting and Licensing by US Universities : An Assessment of the Effects of the Bayh-Dole Act of 1980" (2001) 30 Research Policy 99 ["Mowery"]; *See also*, Annual Licensing surveys which document this trend, Association of University Technology Managers, Surveys, online : <AUTM http://www.autm.net/surveys/> (last accessed January 22, 2011).

[52] *See*, Statistics Canada, Survey of Intellectual Property Commercialization in the Higher Education Sector, Statistics Canada (2003 edition), online: http://www.statcan.ca/english/research/88F0006XIE/88F0006XIE2005018.pdf (last accessed on January 22, 2011).

[53] *See*, M. Herder and J. Johnston, "Access Concerns and Business Models in Public-Sector Technology Transfer of Genetic Inventions" in E.R Gold and B.M Knoppers eds. *Biotechnology IP & Ethics* (Ontario: LexisNexis, 2009) at 165. ["Herder & Johnston"]

[54] *See*, W.M. Cohen, R. Nelson and J. Walsh, "Links and Impacts: The Influence of Public Research on Industrial R&D" (2002) 48 Management Science 1 at 16; *See* also, C. Weiner, "Patenting and Academic Research: Historical Case Studies" (1987) 12 Science, Technology & Human Values 50.

and researchers are mostly interested in their freedom to research and not commercialization.[55] Formalized technology transfer has been embraced by Canadian academic institutions since 1985 due to increased public research funding.[56] This chapter examines the laws and policies supportive of commercialisation of scientific research in US and Canada to ascertain the presence of a "developmental" model. Furthermore, this chapter discusses the issues connected to the start of the academia-industry partnership and its impact on the traditional enterprise of "knowledge sharing." The aim is to address possible conflicts that arise as a consequence of commercialisation of academic and scientific research. The potential effects of capitalistic measures on innovation and scientific endeavours are further summarised.

There are four sections in this chapter, section 3.1 introduces technology transfer as a mission of universities and research institutes; section 3.2 explains the theoretical models of optimum scientific production to emphasize upon the need for disclosure of scientific research results and knowledge sharing; section 3.3 discusses government approaches to commercialisation of university generated intellectual property and technology transfer, namely the US *Bayh Dole Act* 1980, and specific laws and policies supporting commercialisation of research in Canada. Brief discussion of the issues of patenting on innovation and scientific progress is undertaken by explaining the relevance of the

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[55] For one sample study of European scientists and researchers, *see*, S. Breschi and V. Tartari, "Set Them Free: Scientist`s Perceptions of Benefits and Costs of University- Industry Research Collaboration" in Papers Presented at the Summer Conference 2009 (Denmark: Copenhagen Business School, 2009).

[56] *See* also, J. Garcia, "Tech Transfer Practices Canada Vs USA" online: http://garcantechnologies.com/archives/113 (last accessed September 12, 2011) where the author opines that the lack of a country-wide policy governing the practice of commercialising university research in Canada makes for a significantly different approach from that of the US.

statutory exemption for experimental use of research material. Lastly, section 3.4 summarises this chapter.

3.1 Technology Transfer as a Mission of Research Institutes

University research has traditionally been "predicated on the free flow and open sharing of knowledge."[57] The norm of open science is widely restated in several university mission statements and declarations. For instance the mission statement of the Massachusetts Institute of Technology (MIT) states:

> [T]he Institute is committed to generating, disseminating and preserving knowledge and to working with others to bring this knowledge to bear on the world's great challenges.[58]

International declarations such as the UNESCO *Recommendation Concerning the Status of Higher-Education Teaching Personnel* (November 11, 1997) also reiterate this sentiment:

> [...] Higher education teaching personnel should be free to publish the results of research and scholarship in books, journals and databases of their own choice [...][59]

> Higher education teaching personnel have a right to carry out research work without any interference, or any suppression, in accordance with their professional responsibility.[60]

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[57] *See*, B. W. Jones, "Knowledge Commons or Economic Engine – What's A University For?" (2005) 31 J. Med Ethics 249 at 249.

[58] *See for example*, MIT Mission Statement online : http://web.mit.edu web.mit.edu/mission.html (last accessed on January 12, 2011); *See* also, York University, "The Mission of York University is the pursuit, preservation and dissemination of knowledge" online : http//www.yorku.ca/web/about_yorku/mission/ (last accessed on January 12, 2011); *See* also, Y. Joly, "Wind of Change : In Re Fisher and the Evolution of the American Biotechnology Patent Law" (2006) 24:1 Law in Context 67 at 68 for a similar reiteration in the context of American universities.

[59] *See*, *UNESCO Recommendation Concerning the Status of Higher-Education Teaching Personnel*, Art 12.

[60] *See*, *UNESCO Recommendation Concerning the Status of Higher-Education Teaching Personnel*, Art 29.

Scientific publications and research papers have all the attributes of technology, that is they are characterised of scientific knowledge fixed in a medium, which is capable of problem solving, is legally protectable as copyright and transferable to the reader as publication. Therefore, publishing an experimental result or even a scientific discovery would constitute 'indirect' technology transfer. The primary reason research institutes engage in 'direct' technology transfer is to enhance the likelihood that new discoveries and innovations, new uses of physical materials, and new applications of science to solve industrial and medical problems, will lead to useful products, processes and services throughout the world economies. Technology transfer propels new research collaborations, exchanges of materials, information and personnel with industry, adding new dimensions to university research programs and, at the same time, presents unique research opportunities for faculty and students. The resulting income stream from royalties is shared with inventors, which may assist in retaining faculty who might otherwise leave the research institute to pursue more lucrative careers in the for-profit sector. The income benefits the research institute, as it is reinvested in new research and teaching programs and provides financial support for research.[61]

Figure 3 illustrates a situation where a faculty scientist who has a grant to conduct research from a federal fund carries out research with her staff and students and develops a technology. The next step towards commercialization is the market evaluation of the newly developed technology. If the market assessment indicates that there is potential value for the technology, intellectual property protection is sought for the same, for instance by means of filing for patents. This stage is followed by negotiations with

[61] *See*, Table 1: Revenue Sharing Policy of Mount Sinai Hospital, Ontario, Canada at 21, wherein 20% of the revenue is diverted back to the research fund administered by Director of Research.

interested parties for the technology. Such negotiations are usually carried out by the Technology Liaison Officers (TLOs). Depending on the nature of technology and the progress with the negotiations, either the new technology is licensed to a company, royalty-free licenses for not-for-profit organizations may be arranged, an industry sponsored agreement may be entered into or a new start up may be formed for the purpose of commercializing the technology.

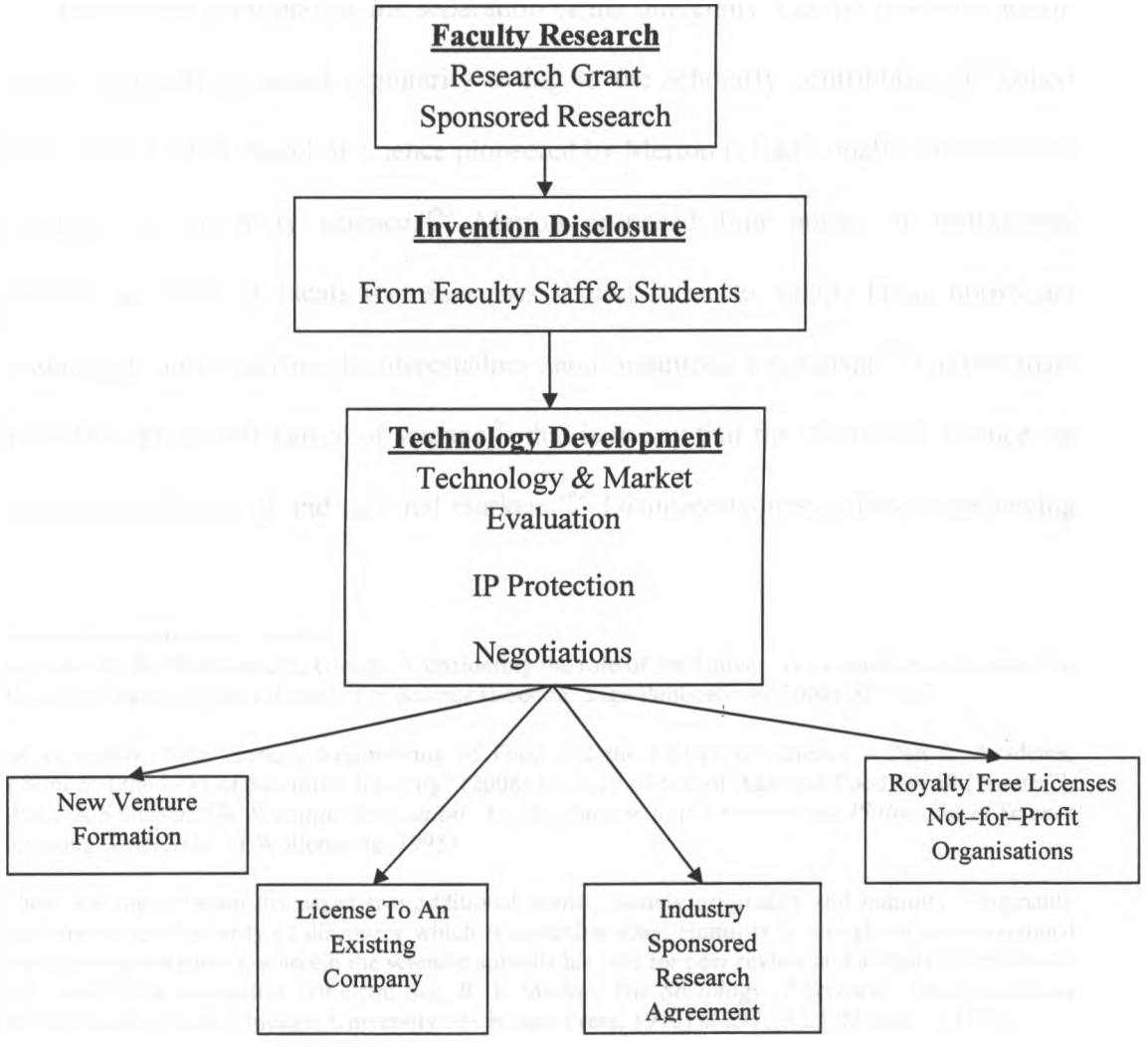

Figure 3: Commercialization of Academic Research

3.2 Knowledge sharing: Preserving the ethos of science

Vannevar Bush is credited with conceiving a model known as the 'public good' model for the American universities and research institutes in 1945. The 'public good' model proposed:

> Researchers are to focus on basic science and are entitled to the freedom to pursue scientific research wherever it leads, whether potentially profitable or not, and that there is to be a separation of the university and the private sector.[62]

This model presupposes the separation of the university and the for-profit sector. A similar assumption gained popularity owing to the scholarly contribution of Robert Merton. The CUDOS model of science pioneered by Merton is traditionally considered as the "pillars of university science."[63] Merton proposed four norms or institutional imperatives as a set of ideals that scientists should strive to attain. These norms are communalism, universalism, disinterestedness and organized scepticism.[64] Universalism refers to the impersonal nature of science,[65] that is to say that the "claims of science are not constrained by social and national markers."[66] Disinterestedness refers to not having

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[62] *See* generally, R. Welsh and L. Glenna "Considering the role of the University in conducting research on agri-biotechnologies" in *Social Studies of Science* (London: Sage Publications, 2006) 929, 942.

[63] *See*, D. Lotter, "The Genetic Engineering of Food and the Failure of Science – Part 2: Academic Capitalism and the Loss of Scientific Integrity" (2008) 16 Intl J of Soc of Agri and Food 50, 68 ["Lotter"]; *See* also, J.A Schuster, *The Scientific Revolution: An Introduction to the History and Philosophy of Science* (Wollongong: University of Wollongong, 1995).

[64] In later writings Merton discussed two additional norms, namely originality and humility. Originality refers to the value of priority of discovery which is reward-worthy. Humility is thought of as an extended version of disinterestedness, wherein the scientist submits his idea for peer review and accepts the refutation of a cherished idea as positive criticism; *See*, R. K Merton, *The Sociology of Science : Theoretical and Empirical Investigations* (Chicago: University of Chicago Press, 1973) at 297,302. ["Merton - 1973"]

[65] *See* ["Merton - 1973"], *supra* note 64 at 270. Merton mentions that "because there is no such thing as American, French or German science, the claims of science are not accepted or rejected because of "the personal or social attributes of their protagonist; ...race, nationality, religion, class and personal qualities are as such irrelevant."

any vested interest and willingly subjecting the research results for correction, review and retraction at the hands of peers,[67] while organized scepticism is an institutional norm characterized by "hypothesis testing and experimental control."[68]

"Knowledge sharing" is encompassed by Merton's norm of "communalism." The theoretical strength of the norm which calls for the open and full communication of scientific findings and denounces secrecy has been challenged by increased pressure to immediately patent research results by the technology transfer offices (TTOs). Communalism refers to the sharing of scientific information among scientists and for the good of the scientific enterprise. According to Merton, the scientific goods being common property, scientists are expected to adhere to the public character of knowledge. The norms were reflective of the cooperative nature of scientific research. Communalism ensures that "secrecy was condemned, while timely, open publication was rewarded."[69] According to Merton:

> The substantive findings of science [...] constitute a common heritage in which the equity of the individual producer is severely limited. An eponymous law or theory does not enter into the exclusive possession of

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[66] *See*, D. Kellogg, "Towards a Post-Academic Science Policy: Scientific Communication and the Collapse of the Mertonian Norms" (2006) Intl J of Communication Law and Policy 4 ["Kellogg"] wherein Kellogg mentions, "Universalism for Merton does not mean that the claims of science are universally applicable or universally true; his point is that limits on scientific claims are determined by the rules of science rather than by the prejudices of society."

[67] *See* also ["Lotter"] *supra* note 63 at 2, wherein Lotter mentions that Merton held the view that "scientists must remain detached from their research, and that results must always be subject to healthy skepticism"; *See* also, ["Kellogg"], *supra* note 66 at 4, wherein Kellogg mentions, "[b]y referring to science as disinterested, Merton does not mean that scientists possess no internal motivation. Scientists are surely guided in their work by passions and commitments; however, in submitting their work to peer review and testing by the scientific community, Merton pointed out, scientists subordinate their own interests to the wider protocols of the institution."

[68] *See* ["Kellogg"], *supra* note 66 at 5.

[69] *See* ["Merton - 1957"], *supra* note 64 at 45:557.

> the discoverer and his heirs, nor do the mores bestow upon them **special rights of use and disposition**. Property rights in science are whittled down to a bare minimum by the rationale of the scientific ethic.[70] [*emphasis added*]

Merton seemed to have referred to patents as a tool whose rights of use and non-use lead to the suppression or withholding of knowledge, as opposed to the rationale of scientific production and diffusion.[71] In the main, Mertonian communalism advocated the notion that, "secrecy is the antithesis of this norm"[72] and that "scientists may not hoard the information they develop or the conclusions they draw, but they must freely share their results, methods and materials."[73]

> [C]ommunalism is the norm of open science by which scientific knowledge belongs to the community and should be "assigned to the community" rather than the scientist [...][74]

The rationale behind this notion is that disclosure of scientific information may lead to further innovation or even improved research results, thereby facilitating progress and development. Therefore, the Mertonian model, and especially the norms of disinterestedness and communalism reject the possibility for commercializing research and advocate knowledge sharing. Recent legal scholarship reiterates the justification for the communal approach as a role of the University:

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[70] *See* ["Merton - 1957"] *supra* note 64 at 45:557.

[71] *Ibid* at 46: 558.

[72] *See* ["Merton - 1973"] *supra* note 64 at 273.

[73] *See* ["Kellogg"] *supra* note 66 at 4.

[74] *See* especially, J. Thursby and M. Thursby, "Knowledge Creation and Diffusion of Public Science with Intellectual Property Rights" (2008) 2 Frontiers of Economics and Globalisation at 202. ["Thursby and Thursby"]

> [T]he non-profit nature of universities charges them with different roles and responsibilities in society than private actors motivated by different aims and goals.[75]

While industry has a responsibility to investors and shareholders whose motivation is only financial gain, academia in contrast, owes a duty to human kind generally, is motivated by "the quest for knowledge for the sake of knowledge"[76] and is focused on "the disinterested pursuit of truth."[77] Scientific researchers bear a responsibility to propel knowledge into application while keeping the basic science or research tool intact for communal use. In this light, the example of Banting and Best is praiseworthy.[78] They patented the method for producing synthetic insulin so as to monitor its safe production, while making the process available free of charge and entering into several cooperative agreements to produce and distribute the new drug. This study endorses the communal approach advocated by Merton as it is indicative of an open method for achieving accuracy in scientific research and innovation.

One fundamental aspect of scientific research is 'access' to basic science. Traditionally, public research institutions such as universities engaging in scientific research provided access to resource base or basic science to other scientists freely. Nowadays by contrast universities enter into material transfer agreements (MTAs) with

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[75] *See*, B. Robinson, "Pin-Stripes, Test Tubes and Patents: Is the Commercialisation of University Research Consistent with the Fundamental Tenets of the Patent Act?" (2006) 3:2UOLTJ 385.

[76] *See*, J. Henderson and J. Smith, *Academia, Industry and the Bayh-Dole Act: An Implied Duty to Commercialize* (Boston: Association of University Technology Managers, 2002) at 6; *See* also, P. Vallance, "Biotechnology and New Companies Arising from Academia" (2001) 358 Lancet 1804 at 1805.

[77] *See* ["Lotter"] *supra* note 63 at 2 where the author mentions that universities and scientific journals are often viewed as the guardians of integrity in scientific research, endorsing the quality and honesty of the same.

[78] *See*, G. Matkin,"University Intellectual Property Management in the 20th Century : How Did We Get Here and Where Are We Going?," *A Presentation for the Conference on Research and Development and Economic Growth in the 20th Century* (Berkeley : University of California, 1999) ["Gary Matkin"]; *see* also *supra* note 53 at 166 ["Herder & Johnston"].

parties interested in accessing the resource. The increased use of MTAs in addition to patents is a result of the entrepreneurial role of the university. MTAs are essentially contracts between the donor and the recipient of material that the donor is providing to the recipient. Therefore an MTA may forbid the recipient from analyzing the material or even seeking intellectual property rights in anything resulting from use of the material and publication of the results of experiments using the material. Figure 4 is an illustration of a study portraying the various permitted and prohibited uses of MTAs in bio-based technology transfer in Canada:

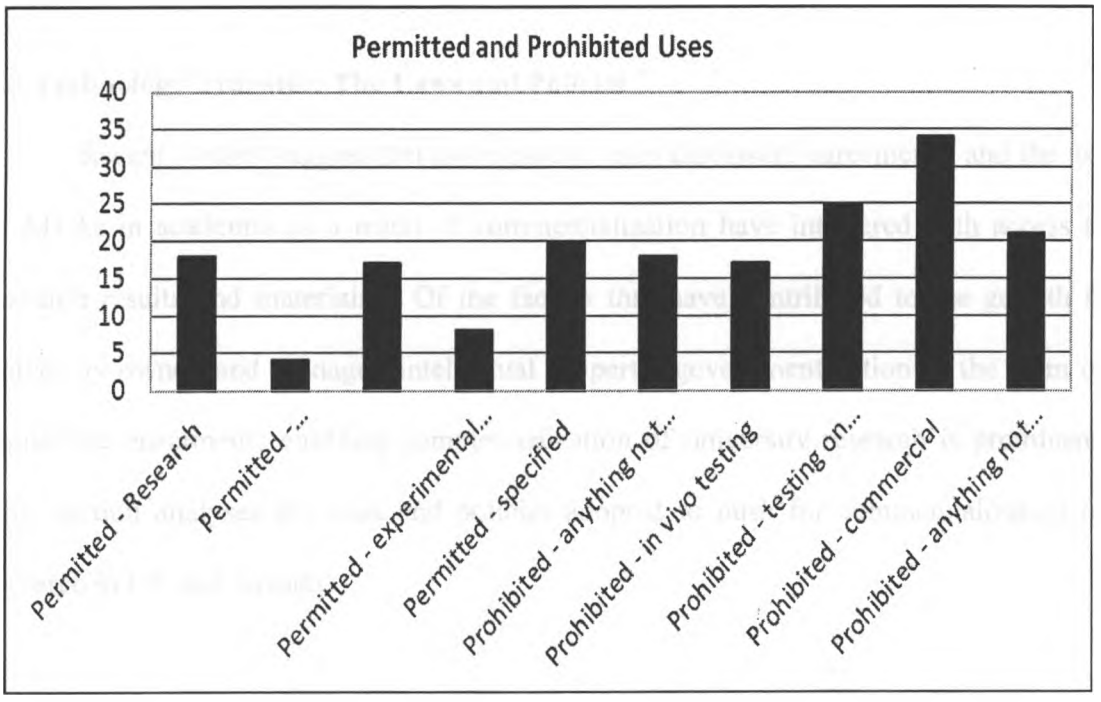

Figure 4: Types of uses contemplated by MTAs[79]

Scholars have opined:

> [S]ome MTAs go so far as to provide that the intellectual property rights resulting from the recipient use of the material shall belong to the donor.

[79] *See*, M. Perry and P. Krishna, "Use of Material Transfer Agreements in Biotechnology in Canada" Poster presentation at Canadian Society of Plant Physiologists Eastern Regional Meeting, November 2007.

> MTAs are becoming more and more widespread, and they are imposing increasingly complex and onerous terms. They typically forbid researchers receiving material to share that material with other institutions and may require pre-publication review of research results. As they are contractual agreements (e.g. between a university and company or between different universities), MTAs are not geographically or temporarily limited. In this respect they differ from patents and can have even more far-reaching effects.[80]

Having discussed the practice of technology transfer generally, the following section discusses the US *Bayh Dole Act* of 1980 as an example of the Government measure for promoting technology transfer by means of full commercialisation of intellectual property generated by universities in the US.

3.3 Technology Transfer: The Laws and Policies

Recent studies suggest that more patents, non disclosure agreements, and the use of MTAs in academia as a result of commercialization have interfered with access to research results and materials.[81] Of the factors that have contributed to the growth in university-owned and managed intellectual property, government action in the form of legislative enactments enabling commercialization of university research is prominent. This section analyses the laws and policies adopted to push for commercialization of research in US and Canada.

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[80] *See*, W. Streitz and A. Bennett, "Material Transfer Agreements: A University Perspective" (2003) Plant Physiology at 23; *See* also, R. Pool, "Material Transfer Agreements" in *Finding The Path: Issues of Access to Research Resources* (Washington, D.C: National Academy Press, 2000).

[81] *See* for example, D. Blumenthal *et al.*, "Data Witholding in Genetics and the Other Life Sciences: Prevalence and Predictors" (2006) 81:2 Academic Medicine 137; *See* also, Y. Joly *et al.*, "Impact of the Commercialization of Biotechnology Research on the Communication of Research Results: North American Perspective" (2007) 8:1 Harv. Health Poly Rev.71.

The US *Bayh Dole Act, 1980* is one element of the strong intellectual property rights policy regime prevalent in the US since 1980s. The legislation is emulated across several countries, including Denmark, Germany, Austria and Norway.[82]

3.3.1 The *US Bayh Dole Act, 1980*: A Full Commercialization Approach

The US Government introduced a change in the policy pertaining to commercialization of public funded research after World War II. Government supported research and development had proven successful in two core research areas: Firstly, the development of weapons that aided winning the war; and second, the development of medical capabilities that greatly reduced casualties both from wounds and infectious diseases compared with earlier wartime experiences. This drew extensive public attention while the US Government debated the governance of publicly funded research. It was then that Vannevar Bush in *Science, the Endless Frontier*[83] argued for a self governing scientific community but with national priorities, such as health and national security, playing a role in setting broad research directions. Thus, mission oriented agencies became government supporters of basic research. For example, the Department of Defense funded basic work in computers, material science and electrical engineering. The Atomic Energy Commission had the responsibility for funding high energy physics while the National Institutes of Health (NIH) and the National Science Foundation became the funders of university science and biomedical sciences.

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[82] *See* for an elaborate discussion, N. Baldini, "Negative Effects of University Patenting: Myths and Grounded Evidence" (2008) 75:2 Scientometrics 7.

[83] *See,* V. Bush, *Science, The Endless Frontier* (Washington D.C: National Science Foundation, 1945).

In 1980, the US Congress enacted a new law to create a uniform patent policy among the Federal agencies funding research. The *Bayh Dole Act, 1980*[84] allowed universities and other federal research fund recipients to elect title to resulting inventions, rather than the Government.[85] Of the Government owned thirty thousand patents only 5% led to new or improved products.[86] Many patents were not exploited as the Government did not have the resources.[87] The *Bayh Dole Act,* 1980 gave universities the right to seek intellectual property rights in inventions resulting from publicly funded research, and this resulted in exclusive licensing. Industry obtained an incentive to contribute to university research because of the potential of reaping exclusive benefits through licensing and commercialization agreements.

The Act has been described in the literature as a broad transformation illustrating the law of "unintended consequences."[88] Section 200 of the *US Bayh Dole Act, 1980* describes the legislative purpose of the Act:

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[84] P.L. 96-517 (*Patent and Trademark Act Amendments of 1980*).

[85] *See* also, T. Silverstein, Y. Joly, E. Harmsen and B.M. Knoppers, "The Commercialization of Genomic Academic Research : Conflicting Interests" in R. Gold and B.M Knoppers eds. *Biotechnology IP and Ethics* (Canada: LexisNexis, 2009) at 131 ["T. Silverstein *et al* – Commercialisation & Conflicting Interests"] noting that, "the 1980s witnessed the landmark ruling of *Diamond v Chakrborthy* (447 U.S.303 (1980) which along with the subsequent enactment of the *Bayh Dole Act* in the US had the effect of encouraging the commercialisation of inventions developed under federal funding by public institutions and small businesses. The creation of the Court of Appeals for the Federal Circuit also helped pave the way for sometime of intense commercialisation of fruits of biotechnology research in the US."

[86] *Ibid*; *See* also, D. Mowery, R. Nelson, B. Sampat and A. Zeidonis, "The Effects of the Bayh-Dole Act on U.S. University Research and Technology Transfer: An Analysis of Data from Columbia University, the University of California, and Stanford University" (2001) Research Policy 1 online : http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.23.7017&rep=rep1&type=pdf.(last accessed on January 12, 2011). ["Nelson *et al.*"]

[87] *See* ["Nelson *et al.*"] *supra* note 86.

[88] *See generally*, L. Ritchie de Larena, "The Price of Progress: Are Universities Adding to the Cost" (2007) 43 Houston Law Review, Part V opening paragraph at 24. ["Ritchie de Larena"] at 1374.

> It is the policy and objective of the Congress to use the patent system to promote the utilization of inventions arising from federally supported research or development; [...] to promote collaboration between commercial concerns and non-profit organizations, including universities; to ensure that inventions made by non-profit organizations and small business firms are used in a manner to promote free competition and enterprise **without unduly encumbering future research and discovery**; [...] to ensure that the Government obtains sufficient rights in federally supported inventions to meet the needs of the Government and protect the public against non-use or unreasonable use of inventions; and to minimize the costs of administering policies in this area.[89] [*emphasis added*]

According to the Association of University Technology Managers (AUTM) by 2006 the US work force in the technology transfer offices (TTOs) had grown to over 1800 and this work force has reviewed over 15908 patent applications within a span of eighteen months.[90] Studies conducted by Mowery, Nelson, Sampat and Ziedonis[91] have found that though the *Bayh Dole Act* resulted in an increase in academic patenting, the increase was accompanied by harm to the public domain of science. No exceptional gain in terms of income by way of licensing revenue or royalty was noted.[92] With these outcomes, it can be concluded that the full commercialization approach through intellectual property portfolios and licensing adopted by the US may have not achieved the goals of public interest.

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[89] *See*, U.S.C. Title 35, Part 2, Chapter 18, § 200.

[90] Association of University Technology Managers, FY US Licensing Activity Survey, 2007, online : Association of University Technology Managers http://www.autm.net/events/file/AUTM_06_US%20LSS_FNL.pdf (last accessed on January 12, 2011).

[91] *See*, D. Mowery, R. Nelson, B. Sampat and A. Zeidonis, "The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh–Dole Act of 1980" (2001) 30 Research Policy 99. ["Mowery *et al.*"].

[92] *See* ["Mowery *et al.*"] *supra* note 91 at 106.

Canada has no law similar to that of the *US Bayh Dole Act*, the 'not-so-full-commercialization approach' to research in the Canadian context is analysed in the following sections.

3.3.2 The Canadian approach to commercialization of public funded research

Several efforts have been made by the Canadian Government to regulate the commercialization of public funded research. Canada has relied less on legislation and more on government statements, policies and aims in the field. A chronological account of the measures is presented herein below:

The Public Servants Inventions Act (PSIA) and Regulations of 1973[93] - The Act laid down the rule that any invention made by the public servant would be held by the Crown and the public servant could not transfer or use that invention without the due permission of the Crown. It also made provisions for the payment of an award to the public servant if the Crown deemed it to be appropriate.

Title to Intellectual Property arising under the Crown Contract [1991] (revised in 2000)[94] – The government policy had been to assign contractors the right over the intellectual property that was created during their research with the government. The policy was revised in 2000, the purpose of the policy was stated as "commercialization of intellectual property," and the Crown could reserve ownership over the intellectual property rights in the invention on certain conditions and on payment of a sum to the contractor.

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[93] *Public Servants Inventions Act*, R.S.C. 1985, c. 3,10.

[94] *See*, Canada, *Contract Policy Notice 2000-2: Revised Policy on Ownership of Intellectual Property Arising Under Crown Procurement Contracts by the Treasury Board of Canada* (Canada: Treasury Board, 2000).

Retention of Royalties and Fees from the Licensing of Crown-owned Intellectual Property [1993].[95] The Treasury Board approved a submission from the Minister of Industry, Science and Technology and the Minister for Science which authorized the departments and agencies to receive, through supplementary estimates, an annual appropriation equal to all revenues arising from the licensing of Crown-owned intellectual property which the department or agency remitted to the Consolidated Revenue Fund in the previous fiscal year.

Award Plan for Inventors and Innovators [1993][96] – It is a government policy to allow employees responsible for scientific and technological inventions to share in the financial benefits accruing from the commercialization of inventions, and to recognize government use of the inventions of its employees during their lifetime.

Science and Technology for the New Century[97] – On March 11, 1996 the federal government released a statement paper. The statement paper provided leading action plans for science based departments. This was a bulky document which contained the history of technology development policies in Canada, and laid down how the various government departments, university, small research institutes need to work together for the growth of science and technology.

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[95] *See*, Canada, *Policies issued by the Treasury Board in 1993 for Retention of Royalties and Fees from the Licensing of Crown- owned IP* (Canada: Treasury Board, 2000) online: http://www.tbssct.gc.ca/pubs_pol/dcgpubs/ContPolNotices/ip_retention_royalties-eng.asp (last accessed on June 11, 2011).

[96] *See*, Canada, "Policy Issued by the Treasury Board Award, 1993" in *Plan for Inventors and Innovators Policy - Chapter 1-11* (Canada: Treasury Board, 1993).

[97] D. Brassard, *Science and Technology for the New Century* (Canada: The Parliament Library, April 1996) at 21.

Guiding Principles for Management of Intellectual Property issues [Draft 1998] – The draft was prepared by Federal Partners in Technology Transfer, which is an initiative of all Canadian science departments and agencies. The demand, supply and need for intellectual property in Canada were analysed. Sixteen guiding principles of technology transfer which gave guidelines for transferring intellectual property between private and government institutes were adopted.

Title to Intellectual Property Arising Under Crown Procurement Contracts [October 2000] (Replaced the 1991 policy) – This initiative made allowance for the payment of royalty rewards to public servant inventors and key contributors from revenues received from license to other fees by the government, the payment of up to $5000 for internal use of an invention by the Crown, the assignment of ownership of intellectual property to contractors, the retention of revenue from the licensing of intellectual property by government departments to offset their awards program and their intellectual property management costs and a consistent approach to management of intellectual property if the management guidelines are voluntarily adopted.

Though Canada has no law similar to that of the *US Bayh Dole Act*, research intensive Canadian universities committed themselves to triple their commercialization outcomes by 2010 by way of the 2002 Framework on Federally Funded Research.[98] The latest survey report, "Scientific and Technological Activities of Provincial Governments and Provincial Research Organizations," from Statistics Canada also indicate that the

[98] *See* ["T. Silverstein *et al* – Commercialization & Conflicting Interests"] *supra* note 57 at 134, where the authors mention about "the commercialised focus of universities can also be gauged in the formation of significant and long lasting research sponsorship agreements with major corporations."

Provincial Governments are spending millions on research and development (R&D).[99] The actual direct return from the huge investments comes only when the research is commercialized. For instance, the Province of Ontario leads research and development in Canada with over $514 million spent on research and development.[100] In 1997 the Ministry of Education and Training, came up with 'Framework for a Research Policy for Ontario.' The framework laid down 12 key characteristics to form the course of innovation and provide the Province with guidelines for its research.[101] One of the major key characteristics in the framework was to draw a distinction between theoretical and applied research. The framework recognized the need to develop an infrastructure, which could support the application of the research done by universities. The framework also recognized greater need for industry and university cohesion to bring about practical results for the economy. Three indicators were established for measuring the research strengths of each institution.[102] These indicators were the input indicator which measures the amount of research funding, capital equipment, number and stature of researchers in each institution, the output indicator which measures the output of research done, by estimating the number of publications, the impact indicator which checks how much technology was transferred, what part of the technology was commercially viable and made available, and what impact the research had on the economy and society.

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[99] *See*, Statistics Canada, *Survey on Scientific and Technological Activities of Provincial Governments and Provincial Research Organizations,* (August 2010 edition), 2004/2005 to 2008/2009, online : <http://www.statcan.gc.ca/pub/88-001-x/88-001-x2009007-eng.pdf> (last accessed on June 12, 2011).

[100] *Ibid.*

[101] *See*, D. C. Smith, *Framework of Research Policy for Ontario* (Canada : Ministry Of Education and Training,1997) online: <http://www.edu.gov.on.ca/eng/document/discussi/research.html> (last accessed on June 11, 2011).

[102] *Ibid.*

The Ministry of Research and Innovation (MRI) introduced the 'Ontario Research and Commercialization Program' (ORCP) in June 2005 to help innovators take their product to the market.[103] A total of $31.4 million was committed to public research institutions and non-profit organizations through this program to identify promising research and shape ideas into innovative products or services.[104] The Program assists with linking research institutions to companies. For instance, the ORCP supports fifty-five Ontario public research and not-for-profit organizations in their collaboration with numerous technology based industries to identify research, develop and move them more rapidly to the market.[105] The ORCP aids linking companies to researchers, building regional and province wide networks. For instance, Bio-Enterprise Corporation, a Guelph based not-for-profit organization that helps promote agriculture based food, life sciences and bio-products expanded its expertise under the ORCP and linked Ontario's rural and northern companies to develop new uses for agricultural products and waste. Moreover, Ontario's next generation of innovative thinkers are developed by training personnel in practical business skills required to shape future discoveries into products and services; Ontario Centres of Excellence conduct an Ontario Internship program to train graduates in Ontario-based technology.[106] The MRI has formed consortiums of Universities and Institutes that mutually formulate *sui generis* policies to transfer technologies, define the

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[103] *See*, Canada, *Ministry of Research and Innovation Report* (Ontario: MRI, 2005) online: <http://www.mri.gov.on.ca/english/programs/ORC-Program.asp> (last accessed on February 12, 2011).

[104] *Supra* note 103.

[105] *Ibid.*

[106] *Ibid.*

kind of agreements that need to be formulated, and identify procedures to be used to commercialize technology.[107]

C4 is a technology transfer consortium in Southwest Ontario that encourages innovation by promoting commercialization. Comprised of ten universities and research institutions, C4 members co-ordinate their resources, cooperate with governmental and industrial bodies, collaborate in multi-disciplinary research to solve real world problems, and commercialise the results of their research. The C4 members are, University of Western Ontario, McMaster University, University of Guelph, University of Waterloo, Wilfrid Laurier University, University of Windsor, Robarts Research Institute, Lawson Health Research Institute, Hamilton Health Sciences and St. Joseph's Healthcare. The diverse group of Universities and Research Institutes provide a broad and deep base of expertise for world discoveries to draw on. Together the C4 Institutions achieve economies of scale with a more directed effort than could be accomplished individually.

An extensive agricultural program is propagated by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). The Ministry of Health administers about $34 million in research funds most of which are directed to commercializing technologies developed in hospitals and research institutes.[108]

Quebec is another Province where business investment in research and innovation has increased to around $ 511 million from $498 million dollars in one year according to

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[107] *See*, Appendix A: ORCP Consortia Projects in the Province of Ontario at 160.

[108] *Supra* note 107.

the latest Statistics Canada Survey in 2010.[109] The *General and Vocational Colleges Act, 1997*[110] is Quebec legislation which provides for establishment of college centres for facilitating technology transfer so as to support researchers in the Province.

Section 17.2 of the *General and Vocational Colleges Act*[111] states:

> A college may, with the authorization of the Minister after the latter has consulted the Minister of Economic Development, Innovation and Export Trade, establish a college centre for technology transfer which may, in a particular field, engage in applied research, furnish technical assistance to enterprises and provide information [...].[112]

Section 25 of the *General and Vocational Colleges Act*[113] specifically provides for budgetary rules pertaining to allocation of subsidies to colleges establishing and maintaining research centres related to technology transfer. The section states:

> [T]he budgetary rules may also provide, in particular, for the allocation of **subsidies to a college to establish and maintain a college centre for technology transfer**, offer special programs established by the Minister or carry out activities agreed upon with the Minister.[114] [*emphasis added*]

The provincial regulation respecting the criteria of eligibility applicable to initiatives and the modalities of financial participation of the Société Innovatech du sud du Québec also encourages initiatives which shall lead to innovation and technology transfer.

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[109] *See supra* note 99.

[110] *See*, R.S.Q., 1997, Chapter C-29.

[111] *Ibid*, s. 17.2.

[112] *Id.*

[113] *Ibid*, s. 25.

[114] *Id.*

Rule 1 sub-rule 3 of the regulation[115] explicitly provides:

> [A]n initiative submitted to the Société shall lie within the scope of its mission. Such initiative shall primarily have as its ultimate objective the realization in the southern Quebec territory, by direct or indirect means, of activities related to the process of technological innovation, including research and development, technology transfer and the commercialization of innovations.[116]

Among other government actions, one of the main encouragements for technological development is the provision for tax incentives for the promotion of research and development (R&D) in the developed market economy. For instance, section 37 of the *Income Tax Act*,[117] provides for tax incentives for scientific research and experimental development (SR&ED).[118] The Canada Revenue Agency (CRA) administers the SR&ED program, which is a federal tax incentive program to encourage Canadian businesses of all sizes and in all sectors, to conduct research and development in Canada. The resulting advantage of the Government initiative in the main is that it generally allows the deduction of R&D operating expenditure in computing income. The current version of the income tax Interpretation Bulletin, *Scientific Research and Experimental Development Expenditures* (IT-151R5)[119] explains how to identify qualifying expenditures. In essence, IT-151R5 discusses which expenditures qualify for

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[115] *An Act respecting Société Innovatech du sud du Québec*, R.S.Q., c. S-17.2.1, s. 25, r 1(3).

[116] *Id.*

[117] R.S.C. (1985) (5th supp.), c. 1, as amended, (Canada) ["Tax Act"].

[118] *See*, Canada Revenue Agency, *Income Tax Information Circular IC86-4R3 dated May 24, 1994*, for administrative policy for what constitutes SR&ED, online:http://www.cra-arc.gc.ca/E/pub/tp/ic86-4r3/ic86-4r3-e.html (last accessed on March 12, 2011); *See* Appendix B for the definition of SR&ED in the Tax Act at 168 and *see* also ["Tax Act"] Section 127(5) for what constitutes 'Investment tax credit' at 169.

[119] *See*, Canada Revenue Agency, Interpretation Bulletin IT-151R5, "Scientific Research and Experimental Developmental Expenditures" (27 February 1995). online: http://www.cra-arc.gc.ca/E/pub/tp/it151r5-consolid/it151r5-consolid-e.pdf (last accessed on January 12, 2011).

tax incentives and who is eligible to receive them as well as the mechanism by which expenditures of a current and capital nature on SR&ED carried on in Canada may be pooled and deducted in calculating the income from a business carried on by a taxpayer in the year the expenditure is made or in any subsequent year. Being the largest single source of federal government support for industrial R&D,[120] the SR&ED program gives claimants cash refunds and tax credits for their expenditures on eligible R&D work done in Canada. In effect, parties interested in conducting R&D in Canada, can compute income in current or capital expenditure. The prerequisites for recognition include that the claimant's activity must constitute SR&ED, then as per the IT-151R5 one can be certain about what can be deducted for SR&ED.[121]Another example of government initiative favouring technology transfer in developed countries is Canada's combined Federal and Provincial tax incentives to foreign owned as well as locally owned companies.[122] In addition to full tax deduction of current SR&ED expenditures, a tax credit is also available based on qualifying SR&ED expenditures carried out in Canada. The eligibility of deducting the full cost of R&D equipment, no limits on subcontracting and ability to defray part of the R&D expenses incurred abroad on Canadian R&D projects aims at benefitting the scientist researcher.

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[120] *See*, Canada Revenue Agency, "SR&ED Program" online: http://www.cra-arc.gc.ca/txcrdt/sred-rsde/menu-eng.html (last accessed on January 12, 2011).

[121] A noteworthy grey area of CRA's administrative policy is the issue of ascertaining whether the activity constitutes SR&ED. *See* for example, CRA publications discussing what is SR&ED and what is not SR&ED, online: http://www.cra-arc.gc.ca/E/pub/tg/rc4472/rc4472-e.pdf (last accessed on September 12, 2011).

[122] *See*, Foreign Affairs and International Trade Canada,"Do Your Research in Canada, it pays off!" online: http://investincanada.gc.ca/download/142.pdf (last accessed on January 16, 2011) ["FAITC – September 2010"]; *See*, Appendix C for federal SR&ED Program on $5million of qualified SR&ED expenditures and Appendix D for the Federal and Provincial SR&ED tax incentives in Canada at 171 and 172 respectively.

Universities in Canada follow a pattern for *sui generis* policies.[123] Common issues addressed by the university intellectual property policies are disclosure, ownership, commercialization and revenue sharing. Kevin LaRoche *et al.*, define these four parameters:

> [D]isclosure is the obligation of the inventor or inventors to disclose the invention to the university. Ownership, in the simplest sense, is "title" to the invention [...]. **Commercialization is the process of extracting revenue from the invention**; Revenues are the monetary proceeds of commercialization; while they normally accrue to the owner, most intellectual property policies contemplate a sharing as between the university and the inventor, regardless of who the owner is.[124] [*emphasis added*]

The recent progress report of the Canadian Science and Technology Strategy,[125] which provides international comparisons for Canada's performance in science, technology, R&D, commercialization and output, places faith in commercialization through intellectual property portfolios and licensing, similar to the Bayh Dole approach. Analysis of the recent survey data of "Intellectual Property Commercialization in the Higher Education Sector" from Statistics Canada[126] also suggests that the total intellectual

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[123] *See* for example, Industry Canada, *University Research and the Commercialization of Intellectual Property in Canada* (Occasional Paper No.21) (Ottawa: Research Publications Program, 1999); *See* also, Statistics Canada, *Appendix 2: Survey of Intellectual Property Commercialization in the Higher Education Sector* (Ottawa: Science, Innovation and Electronic Information Division, 2003); *See* also, C.R Cates, "Legal Issues within the Intellectual Property Policies of Universities : Standing on the Shoulders of Giants" (XIII 2001) online: The Journal of the Association of University Technology Managers www.autm.net (last accessed on January 12, 2011); *See* also, A. Ketis, J. Rudolph and M. Gravell, "Ownership of Intellectual Property Policies of Canadian Universities : Standing on the Shoulders of Giants" (2002)13 J.AUTM 13.

[124] *See*, K. LaRoche, C. Collard and J. Chernys, "Appropriating Innovation: The Enforceability of University Intellectual Property Policies," (2006/07) 20 I.P.J at 139 ["Kevin LaRoche *et al*"].

[125] *See*, Govt. of Canada, "Science and Technology Data 2009" (April 2011 edition) online: http://www.science.gc.ca/937918F9-DFCD-42C4-992C-E4948CB883EF/2009-e.pdf (last accessed on July 23, 2011); *See* also, J. Atkinson-Grosjean, *Public Science; Private Interests: Cultures and Commerce in Canada's Networks of Centres of Excellence* (Toronto: University of Toronto Press, 2006).

property (IP) income, generated from licensing at reporting Canadian Universities is $53.2 million per year. Table 2 illustrates the survey data based on the questionnaires received representing 125 responding Institutions for income received from intellectual property:

Table 2: Income Received from Intellectual Property - 2008[127]

	Total
	Thousands of Dollars
Total	**53,183**
Running Royalties	35,374
Milestone Payments	4,681
From one time sales of Intellectual Property	3,080
Reimbursement of Patent, Legal and related Costs	5,889
License Income received from another Canadian Institution under a revenue-sharing agreement	125
Other	4034

The reporting institutions employed 321 full-time employees in intellectual property management for a cost of $51.1 million. Table 3 illustrates the data in terms of the expenditure on intellectual property management based on response from 69 institutions with intellectual property offices, engaged in intellectual property management and Table

[126] *See*, Survey of Intellectual Property Commercialization in the Higher Education Sector, Statistics Canada (2008 edition), online: http://www.statcan.gc.ca/pub/88-222-x/2010000/aftertoc-aprestdm1-eng.htm> (last accessed on June 12, 2011). ["Statscan Survey-2008"].

[127] Adopted from Table 15-1 ["Statscan Survey-2008"] supra 126, online: http://www.statcan.gc.ca/pub/88-222-x/2010000/t096-eng.htm (last accessed on June 12, 2011).

4 illustrates, after deduction of the direct costs, the total surplus for all Canadian Universities was $2.1 million *only*. The average income per university from the intellectual property was only $425,500 representing a 9% decrease from the previous year ($468,500 in 2007).[128] The patent applications and patents issued were also down in the reporting institutions and there were less than two-dozen spin-off companies reported by the universities.

Table 3: Expenditure on Intellectual Property Management - 2008[129]

	Expenditure Thousands of dollars
Total operational expenditure for IP management	**51, 124**
Salaries and benefits corresponding to full-time equivalents	28,056
Patent and regular legal expenditure[130]	15, 331
Litigation expenditure[131]	361
Other operational expenditures	7376
Full time equivalent employees engaged in IP management	**321**

[128] *See* ["Statscan Survey-2008"] *supra* 126.

[129] Adopted from Table 2-1 ["Statscan Survey-2008"] *supra* 126, online: http://www.statcan.gc.ca/pub/88-222-x/2010000/t080-eng.htm (last accessed on June 12, 2011).

[130] *See* ["Statscan Survey-2008"] *supra* 126, Patent and regular legal expenditures include those for patent filings, patent searches, registration of copyright, etcetra.

[131] *See* ["Statscan Survey-2008"] *supra* 126, Litigation expenditures are those related to disputes over patents or other intellectual property and include settlements.

Table 4: Income Cost & Surplus - 2008

Particular	Income (Thousands of dollars)	Expenditure (Thousands of dollars)	Surplus (Thousands of dollars)
Total Income Received From IP – 2008 (A)	53,183		
Total operational expenditure for IP management – 2008 (B)		51, 124	
Total Surplus (A - B)			**2059**

The revenue sharing policies in eight prominent universities in Canada based on the analysis of the intellectual property policies reveal a further division of the income generated from commercialization. Table 5 illustrates the allocation of the net income or revenue splitting in prominent Canadian Universities:

Table 5: Allocation of Net Income in 8 Canadian Universities[132]

	Allocation of Net Income (Cumulative unless otherwise indicated)			
University of Toronto	First $1000: 100% Inventor	$1000-$200,000 25% Inventor 50% Innovations Foundation 25% University	$200,000-$500,000 25% Inventor 25%Innovations Foundation 50% University	$500,000+ 25% Inventor 5% Innovations Foundations 70% University
Queens University	First $500,000 100% to Inventor if Self – commercialized, or negotiated by Queen`s, otherwise negotiated allocation if commercialized by Queens		$500,000+ 75% to Inventor if self commercialized. 25% to Queens. Negotiated allocation if commercialized by Queens	
University of Western Ontario	Shared equally Equity in any spin off companies is negotiated between university and inventor			
University of British Columbia	Shared equally			
University of Alberta	2/3 to the party which commercializes and 1/3 to the party which does not			
University of Saskatchewan	Shared equally			
McMaster University	Re-Investment in Research Method: 25% Inventor, 25% University, 35.7% Research, 14.3% Indirect cost recovery if there is investment in research 50% Inventor, 50% University where there is no reinvestment in research			
University of Ottawa	First $100,000 80% Inventor, 20% University		$100,000+ 50% Inventor, 50% University	

[132] *See* ["Kevin LaRoche *et al.*,"] *supra* note 124 at 172; For University Intellectual Property Policies see, McMaster (MILO) online : http://ip.mcmaster.ca/policies/joint_ip_policy (last accessed on June 12, 2011); University of Alberta : http://www.rso.ualberta.ca/intellectualproperty.cfm (last accessed on June 12, 2011); Queen`s University : http://www.queensu.ca/secretariat/senate/policies/intelprp/index.html(last accessed on June 12, 2011); University of Toronto : http://www.utm.utoronto.ca/ipguide3.0.html (last accessed on June 12, 2011); University of British Columbia (Simon Fraser University) : http://www.sfu.ca/policies/gazette/research/r30-03.html(last accessed on June 12, 2011); University of Saskatchewan : http://www.usask.ca/research/ilo/uofs_ip.php(last accessed on June 12, 2011); University of Ottawa : http://www.ttbe.uottawa.ca/researchers/tech_transfer/faq.asp(last accessed on June 12, 2011).

Commercialization particularly involves at least two steps – making the innovation proprietary and thereafter, working or licensing the resulting proprietary rights. Three issues in respect of commercialization arise – who decides whether to commercialize, who decides how to commercialize, and who pays for commercialization. For example, at the University of Western Ontario, London (UWO) the typical provision with respect to third party sponsored research initiatives undertaken by a faculty member provides for the contract to be entered into between the sponsor and UWO, and accordingly, the faculty member assigns his or her right, title and interest in and to any resulting intellectual property rights to UWO, in order for it to be able to perform the obligations under the contract. The negotiation between the sponsor and UWO determines the ultimate ownership of intellectual property rights, with entitlement for compensation to the faculty member as governed by the collective agreement. UWO subscribes to an "inventor-owned" policy, in a case where intellectual property rights would arise from research conducted independent of third party agreements but with requirement under the collective agreement for a report of invention to be made by the faculty member to UWO for discussion of commercialization alternatives. Ownership is not automatically vested in UWO in this instance, but only upon an elective assignment by the faculty member to UWO, again in accordance with the provisions of the collective agreement.[133]

As regards revenue sharing, allocation of the net income earned as a result of commercialization between the inventor and the university is provided in the university intellectual property policy. Revenue sharing is dependent on the specific formula subject to interpretation and accounting methods. For instance, certain intellectual property

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[133] *See*, University of Western Ontario online : http://www.uwo.ca/univsec/mapp/section1/mapp112.pdf (last accessed on June 12, 2011).

policies such as those of the University of Toronto and the University of Alberta permit the inventor to decide whether he or she wishes to commercialize or, alternatively offer the invention for assignment to the university, which may or may not accept.[134] Another example is the intellectual property policy of McMaster University, which allows the university a period of time, following the initial disclosure, during which to decide whether it wishes to commercialize the invention. If it elects not to commercialize, then the intellectual property may, at the request of the inventor, be transferred to him or her. That being said, the same policy allows an inventor who is a member of the teaching staff to request that the university transfer ownership of the intellectual property and provides, further, that university "shall not unreasonably withhold approval of the intellectual property creator's request."[135] The intellectual property policy of Queen's University simply provides that once a disclosure is made the university has an exclusive opportunity, for a defined period of time, to make a commercialisation proposal, which the inventor is free to accept or reject. Many policies provide for a regime of shared decision making in respect of commercialisation issues. Where the university assumes responsibility for commercialisation of the invention, then, the costs of commercialization are borne by the university, subject to the revenue sharing requirement of the policy. Where the inventor is entitled to commercialise and elects to do so, then the inventor bears those costs, subject to the revenue sharing requirements. The manner in which an invention is commercialised can have a significant impact on the revenue available to be

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[134] *See*, *supra* note 132, University of Alberta Faculty Agreement, Appendix C: University of Alberta Patent Policy, Clause 7.1; *See* also, University of Toronto Research-Related Policies: University of Toronto Inventions Policy, Clause 3.

[135] Email correspondence dated April 03, 2011 with David William George Morrison, *former* Business Development Analyst, Technology Transfer Office, McMaster University, Canada.

shared between the inventor and the university. Most intellectual property policies apportion the net profits produced from commercialization. The net profits generated by working an invention can be very different from the net profits produced from a license or sale of that same invention. The former requires that the costs of production and sale be appropriately allocated, while the second does not. In order to ascertain the specific research question of *what are the implications of excessive commercialisation of science and technology on the traditional enterprise of "knowledge sharing"*? the following section discusses expert viewpoints on the issue of university-industry partnership.

3.3.3 Academic capitalism: An evil paradox

The laws and government policies discussed above support increased interaction with industry sponsors with the view to enhance revenue as well as innovation and access to research material. The practice of deploying the human capital of universities that is their faculty, for the purpose of enhancing revenues is also a form of technology transfer termed as "academic capitalism" in the literature.[136] Academic capitalism is defined as

[136] The term "academic capitalism" was first used by E. J. Hackett in a paper, "Science as a Vocation in the 1990s. The Changing Organisational Culture of Academic Science" (1990) 16 J.H.E at 273; *See* also, G. Rhoades and S. Slaughter, *Academic Capitalism and the New Economy* (Baltimore MD: Johns Hopkins University Press, 2009) ["Slaughter and Rhoades"] where the authors track changes in policy and practice in American Universities which reveal new social networks and organisational structures linking higher education institutions and markets. An academic-capitalist-knowledge-regime is depicted in faculty work, departmental activity and administrative behaviour. *See* especially, S. Awbrey, "Making the Invisible Hand Visible. The Case for Dialogue About Academic Capitalism" in *Academic Capitalism and the New Economy* (Baltimore MD: Johns Hopkins University Press, 2009) at 46 where the author mentions, "[t]he major financial advantages of academic capitalism include the generation of funds [...] Nevertheless, those who believe in the 'invisible hand of the market' [Smith, 1776/1976, p. 456] must also recognize the difference between short-term and long-term gains. Even if higher education institutions become totally successful at balancing budgets through academic capitalism, if the way in which this is done leads to a loss of quality in the best higher education system in the world just as we enter the age of knowledge and information [...]then we will have surrendered long-term interests for short-term solutions. Academic capitalism is not the inherent evil some believe nor is it the unmitigated blessing others imagine. It is a strategy that has the potential both greatly to help and greatly to harm universities."

the "institutional and professorial market or market-like efforts to secure external moneys."[137] This practice gained momentum in the 1990s due to the changing role of universities as entrepreneurs.[138] Increased commercialization may not necessarily lead to more revenue and better conditions for research, and may even stifle innovations for which huge public funds are invested. This section further discusses this point.

Geiger and Sa state:

> [I]n their zeal to patent, universities have engaged in practices that can scarcely be regarded as compatible with the public interest. These include **claiming ownership over fundamental scientific knowledge or research tools.**[139] [*emphasis added*]

An unavoidable aspect of commercialisation of academic and scientific research is increased pressure on universities to patent and commercialize research results. A hasty approach gives way to a decline in the quality of patents,[140] the substitution between basic and applied research,[141] substitution between patents and publications[142] and decline of publications' quality[143]as well. Proliferation of intellectual property rights on basic or

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[137] *See*, L. Leslie, R. Oaxaca and G. Rhoades, "Technology Transfer And Academic Capitalism" in *Academic Capitalism: Politics, Policies and the Entrepreneurial University* (Baltimore MD: Johns Hopkins University Press, 1997) at 8. ["Slaughter and Leslie"].

[138] *See*, ["Slaughter and Leslie"] *supra* note 137 at 261, noting that, "[a]cademic capitalism seems to characterize higher education in virtually all of the Organisation for Economic Cooperation and Development (OECD) countries."

[139] *See*, ["Geiger and Sa"] *supra* note 50 at 144.

[140] *See*, R. Henderson, *et al.*, "Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting, 1965–88" Working paper # 5068, (Cambridge, MA : National Bureau of Economic Research, 1995) for a reference to consequent decline in the quality of patented products.

[141] *See*, J. Thursby and M. Thursby, "Who is selling the Ivory Tower? Sources of Growth in University Licensing" (2002) 48 Management Science at 90 ["Thursby and Thursby"].

[142] *See*, A. Agrawal and R. Henderson, "Putting patents in context: Exploring knowledge transfer from MIT" (2002) 48 Management Science, 44–60.

[143] *See*, F. Murray and S. Stern, "Do Formal Intellectual Property Rights Hinder the Free Flow of Scientific

early stage upstream research results may stifle downstream research and development.[144] The reason is that the greater number of people whose agreement has to be obtained in order to allow a project to proceed, the higher the risk that bargaining will fail or that transaction costs will become too high. This will be even more likely if the property rights belong to actors in both the public and the private sector, with different institutional agendas. Increased private public partnership was basically aimed to ensure that more industry funding may be directed towards areas such as health and consumer welfare which require more attention. However, several issues emerge due to academic patenting and increased interaction between the university and industry.

Scientist researchers are bound by contractual obligations in the nature of restrictions to share knowledge or data,[145] restrictions on disclosure of research results,[146] and restrictions on transfer of research tools.[147]The Industry may also suffer from

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Knowledge? An Empirical Test of the Anti-commons Hypothesis" Working paper # 11465, (Cambridge, MA : National Bureau of Economic Research, 2005) where authors share concerns related to academic patenting and dissemination of scientific information.

[144] *See*, M. Heller and R. Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research" (1998) Science 698,701. ["Heller and Eisenberg"]; *See* also, R. Eisenberg, "Bargaining over the transfer of proprietory research tools: Is this market failing or emerging?" in R. Dreyfuss, D. Zimmerman and H. First eds. *Expanding the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society* (Oxford: Oxford University Press, 2001) at 223; *See* also, A. Rai, "Regulating Scientific Research: Intellectual Property Rights and the Norms of Science" (1999) NW.U.L.Rev 94; *See* also, R. Nelson, "Observations on the Post-Bayh-Dole Rise of Patenting at American Universities" 2001 JTT 26.

[145] *See*, D. Blumenthal *et al.*, "Withholding research results in academic life science. Evidence from a national survey of faculty" (1997) 277 JAMA 1224, 1228.

[146] *See*, W. Cohen *et al.*, *University-Industry Research Centres in the United States* (Mimeo: Carnegie Mellon University, 1994) at 52.

[147] *See*, J. Walsh, A. Arora, W. Cohen, "Research tool patenting and licensing and biomedical innovation," in W. Cohen and S. Merril eds. *Patents in the Knowledge-Based Economy* (Washington, D.C. : The National Academies Press, 2003) at 285, 340.

restrictions on university-industry communications,[148] obstacle to new research fields and unreasonable cost increase.[149]

Garret Hardin had advanced "the tragedy of the commons" in 1968 to address the problems of over population and the management of scarce resources.[150] Accordingly, the "tragedy of the commons" occurs when multiple owners are each endowed with the privilege to exploit a scarce resource, and no one can exclude the others from using such resources. The resource is then prone to suffer from the problems of over use, waste, no incentive to conserve and the eventual destruction of common property. Privatization is seen as a solution to this tragedy since it creates an incentive for the efficient use and enjoyment of scarce resources and minimizes the cost and externalities associated with common ownership. Nonetheless, one must bear in mind that intellectual property does not have the characteristic of excludability like that of tangible property. The possession and use of intellectual property is primarily non-rivalrous. There is no danger of over use or over distributing intellectual property, since everyone can use it without diminishing its value. Therefore traditional economic justification for tangible property does not fit intellectual property.[151] Just as *too few* property rights can lead to *overuse* of resources in a "tragedy of the commons", too many property rights can cause *underuse* of resources in a "tragedy of the anti-commons" where too many owners can block each other's

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[148] *See*, W. Cohen *et al.*, "Links and impacts: The influence of public research on industrial R&D" (2002B) 48 Management Science, 1–23.

[149] *See*, J. Colyvas *et al.*, "How do university inventions get into practice?" (2002) 48 Management Science, 61–72.

[150] *See*, G. Hardin, "The Tragedy of the Commons" (1968)162 Science 1243, 1248 ["Hardin-1968"]; *See* also, G. Hardin, "Extensions of "The Tragedy of the Commons" (1998) 280 Science 682, 683. ["Hardin-1998"].

[151] *See*, P. S. Menell, "1600: Intellectual Property: General Theories" in *Encyclopedia of Law and Economics* (Cheltenham, UK : Edward Elgar and The University of Ghent,1999) at 129 online: http://encyclo.findlaw.com/1600book.pdf (last accessed on August 02, 2011)

application of knowledge.[152] While the "tragedy of the commons" underlines the costs of overuse of a scarce resource, it ignores the possibility of underuse when too many owners are given rights to exclude others from its use. Privatization may solve one tragedy while creating another.

Michael Heller described this as the "tragedy of the anti-commons." Viewing it as a mirror of "the tragedy of the commons," "the tragedy of the anti-commons" occurs when multiple owners are endowed with the right to exclude others from a scarce resource and no one has an effective privilege of use. When there are too many owners holding rights of exclusion, the resource is prone to underuse. The "tragedy of the anti-commons" is an absurd consequence of patents. Patents are a double edged sword, which hold both promises and risks to technology advancement. Patents encourage inventors to engage in the inventive activity because they result in equitable distribution of the profits of R&D. However, in the event that too many owners hold patents in previous inventions, distortion of the inventive activity and obstacles to future research are inevitable.

> [C]omplex obstacles that arise when a user needs access to multiple patented inputs to create a single useful product. Each upstream patent allows its owner to set up another tollbooth on the road to product development, adding to the cost and slowing the pace of downstream…innovation.[153]

The growth of upstream patents leads to royalty stacking and a reduced number of players in the research field, which hinder or limit the development of new products onto

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[152] *See*, M. Heller and R. Eisenberg "Can patents deter innovation? The anticommons in bio-medical research," (1998) 280 Science 698,701; *See* also, R. Henderson *et al.*, "Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting, 1965–88" Working paper # 5068, (Cambridge, MA : National Bureau of Economic Research,1995) at 22.

[153] *See*, ["Heller and Eisenberg"] *supra* note 144 at 698.

the market. Eisenberg and Heller point to the problematic situations arising from royalty stacking or license stacking:

> [A] Reach Through License Agreement (RTLA) used in upstream stages of research, gives the owner of a patented invention, rights in subsequent downstream discoveries. Such rights may take the form of a royalty on sales that result from use of the upstream research tool, an exclusive or nonexclusive license on future discoveries, or an option to acquire such a license...RTLAs may lead to anti-commons as upstream owners stack overlapping and inconsistent claims on potential downstream products. In effect, **the use of RTLAs gives each upstream patent owner a continuing right to be present at the bargaining table as a research project moves downstream toward product development.**[154] [*emphasis added*]

Royalty stacking leads to delays for the product's arrival in the market due to license negotiations or the product may be priced at an expensive level, wherein only a few of the possible users can afford it, or worse the product may not reach the market at all. The number of players in the research field will be reduced due to upstream patenting. Unlike traditional patents for commercial end products, which are rarely infringed by university researchers, research tool patents, which are patentable subject matter, being novel, unobvious and useful but equally fundamental for developing new applications, cover almost by definition the type of research carried out by academics and scientist researchers. Therefore unregulated use of patented research tools in the absence of a research exemption is discouraged.

3.3.3.1 The experimental use exception: A peculiar exemption

One area where patents can have significant negative effect is research. The reason is that along with the final products, patenting of research tools may impede future research. Therefore, if a scientist requires research tools which are already patented, he or

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[154] *Ibid.*

she is forced to seek authorisation to use certain research tools in a project. If several patented tools are required, the expense of the license rights can quickly become prohibitive. Therefore, patents can restrict research by slowing the process and imposing additional costs. In order to combat these barriers, *research exceptions* have been enacted by some countries in their patent legislations. It is arguable that Articles 30 read with Article 8 of the *World Trade Organisation's Agreement on Trade related aspects of Intellectual Property Rights, 1995* (TRIPS Agreement)[155] allows for the introduction of legislated research exceptions, also called research exemptions or experimental use clauses. Article 8 permits member states to adopt measures necessary to protect public health and nutrition and to promote the public interest in sectors of vital importance to their socio-economic and technological development. Article 30 holds that member states are allowed to provide limited exceptions to the exclusive rights conferred by a patent.

Research exceptions grant researchers the right to innovate in a field where patents have been granted and to undertake studies focussed upon a patented invention or using a patented tool without having to pay royalties to the patentee. However, the exact scope of research exception being unclear at this time weakens the effectiveness of such clauses.[156] For instance, in Canada the prime source of confusion is created by the fact that it is undetermined whether research that could result in a commercial outcome qualifies for a patent exemption. Two aspects of section 55.2 of the *Canadian Patent Act*[157] which provides for research exemption are, first, it is not an infringement to make,

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[155] *See, Annex 1 C of The Marrakesh Agreement Establishing the World Trade Organisation*, 33 I.L.R. 1197 (1993).

[156] *See*, E. R. Gold and A. Gallochat, "The European Directive: Past and Prologue" (September 2001) 7:3 Euro L.J 358 for an example of research exception pertaining to genetic material.

[157] *The Canadian Patent Act*, R.S.C 1985, c. P-4.

construct, use or sell a patented invention solely for uses reasonably related to the development and submission of information required under any law of Canada, second, research upon the subject matter of the patent that has a non-commercial purpose is permitted. Lobby groups support a general research exception for studies investigating the properties of a patented material to improve upon an invention or creating a new product or process.[158] These suggestions have not been implemented and even the courts have articulated some confusion about the nature of the research exemption that does exist.[159]

Research tools are important to the progression of scientific studies. Some countries lack the research facilities and know how necessary to adapt generic tools to their own needs. The end result is that freedom from infringement allegations is worthless and that research tools remain unavailable to most developing countries. A dependence remains either on the research carried out in the developed countries or upon collaborative efforts with researchers belonging to the developed countries in order to create products that respond to the population specific needs.[160] Research tools should be subject to broad exemption than other patented inventions for scientific progress.

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[158] Ontario, Ministry of Health and Long-Term Care, *Genetics, Testing and Gene Patenting : Charting New Territory in Healthcare* (Toronto: Ministry of Health and Long-Term Care, 2002) at 40, online : Ontario Ministry of Health and Long-Term Care www.health.gov.on.ca/english/public/pub/ministry_reports/geneticsrep02/report_e.pdf (last accessed on January 12, 2011).

[159] *See* for example the brief discussion in *Harvard College v Canada (Commissioner of Patents)*, [2002] 4 S.C.R 45 at *para* 174 (S.C.C); *See* also, M. Perry and P. Krishna,"Making Sense of Mouse Tales: Canada Life Form Patents Topsy-Turvy" (2001) 23(4) E.I.P.R. 196 ["Perry and Krishna"]; *See* also, the Supreme Court of Canada decision in *President and Fellows of Harvard College v Canada (Commissioner of Patents)*, [2002] S.C.J. No. 77 (S.C.C.) ["Harvard Mouse"] wherein the Supreme Court of Canada allowed the appeal.

[160] *See*, J. H. Barton, "Research-Tool Patents: Issues for Health in the Developing World" (2002) 80:2 Bulletin of the World Health Organisation 121.

For instance, in the case of India, section 47(3) of the *Patent Act of 1970* excludes from the exclusive patent right "any machine or other article in respect of which the patent is granted may be made or used by any person, for the purpose merely of experiment or research including the imparting of instructions to pupils."[161]

The absence of a research exemption or exception for experimental use in the patent law will require even academic researchers, who do not engage in commercializing technology, to seek licenses for accessing technologies and materials vital for basic research. As a result research may suffer undue delays or be rendered redundant. An experimental use exception provides an opportunity for researchers to circumvent patent infringement. Article 30 of the TRIPS Agreement allows for utilizing this exception, without violating the agreement. The Article provides:

> Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties.[162]

The experimental use exception in Canada is in an uncertain state. Both common law and the *Patent Act* provide for it. The Canadian position with respect to the experimental use exception has been articulated by Justice Hall in the matter of *Smith Kline & French Inter-American Corp v Micro Chemicals Ltd.*[163] *Per* Justice Hall:

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[161] *See*, *The Patent Act of 1970*, section 47(3).

[162] *See*, *Agreement on Trade-Related Aspects of Intellectual Property Rights*, 15 April 1994, 1869 U.N.T.S. 299 (being Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization, 1867 U.N.T.S. 3). ["TRIPS"].

[163] *Smith Kline & French Inter-American Corp v Micro Chemicals Ltd.* (1971), [1972] S.C.R. 506. ["Micro Chemicals cited to S.C.R"]

> [N]o doubt if a man makes things merely by way of bona fide experiment, and not with the intention of selling and making use of the things so made for the purpose of which a patent has been granted, but with the view of improving upon the invention the subject of the patent, or with the view of seeing whether an improvement can be made or not, that is not an invasion of the exclusive rights granted by the patent. Patent rights were never granted to prevent persons of ingenuity exercising their talents in a fair way. But if there be neither using nor vending of the invention for profit, the **mere making for the purpose of experiment**, and not for a fraudulent purpose, ought not to be considered within the meaning of the prohibition, and if it were, it is certainly not the subject for an injunction.[164] [*emphasis added*]

Furthermore, subsection 55.2(1) of the *Patent Act* provides for the statutory experimental use exception:

> [T]o make, construct, use or sell the patented invention solely for uses reasonably related to the development and submission of information required under any law of Canada, a province or a country other than Canada that regulates the manufacture, construction, use or sale of any product.[165]

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[164] *See* ["Micro Chemicals"] *supra* note 163 at 519-520, quoting Jessel MR in *Frearson v Loe*, (1878), Ch. D. 48 at 66-67; *see* also, B. Robinson, "Pin-Stripes, Test Tubes and Patents: Is the Commercialization of University Research Consistent with the Fundamental Tenets of the Patent Act?" (2006) 3:2 UOLTJ 385, wherein Robinson mentions, "[A]t issue in Micro Chemicals was whether the purpose of examining the manufacturing process of a patented invention constituted patent infringement. As Micro chemicals was not manufacturing the patented substance for profit, but rather ensuring the successful manufacture of the patented product in generic form, the court held that Micro Chemicals fell within the ambit of the experimental use exception, and was therefore not liable for patent infringement. However, as Micro Chemicals addressed the issue of compulsory licensing, a provision since repealed from the Patent Act [...] the nature and scope of this exception is now uncertain." ["Brent Robinson"]; *See* also, *Apotex Inc v Canada (AG)* (1996) 71 C.P.R. (3d) 166, 123 F.T.R. 161 at paras. 6-7, 16 (FCTD) ["Apotex"], previously the Patent Act provided for a system of compulsory licensing allowing manufacturers of generic versions of patented brand names to manufacture or import and use the generic version until expiry of the patentee's patent on the similar product in exchange for royalties. Ss. 55.2(2) and (3) were repealed in 2001. Ss. 55.2(1) and (4) now provide for the development of the generic brand and for application for regulatory approval without infringement of the patent.

[165] *Patent Act, R.S.C. 1985*, c.P-4, s.55.2(1)

The most common circumstances where this provision applies are where generic drug manufacturers, prior to the expiration of a patent, are in the development and approval stage of a generic version of a patented product.[166]

Further subsection 55.2 (6) which is more relevant for the purposes of the experimental use exception generally, provides that subsection (1) does not abrogate any exception afforded by the common law with respect to:

> [A]cts done privately and on a non-commercial scale or for a non-commercial purpose or in respect of any use, manufacture, construction or sale of the patented invention solely for the purpose of experiments that relate to the subject-matter of the patent.[167]

The above is the codification of the common law experimental use exception. However, very limited judicial interpretation of the statutory exception is available to determine the scope of the defense. Brent Robinson notes, "this is particularly so with respect to research conducted on patented products in university laboratories that may, although perhaps not initially intended to, result in a highly profitable research-product from experimentation with the patented invention."[168]

The uncertain state of the experimental use exception in Canada warrants that some reliance be placed on the persuasive value of the decisions of the US courts for the purpose of determining the scope of the exception in Canada. The seminal decision by the Court of Appeals for the Federal Circuit in the US in the matter of *Madey v Duke*[169] and

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[166] *See* ["Apotex"] *supra* note 164 at *para* 16.

[167] *Patent Act, supra* note 165, s. 55.2(6).

[168] *See* ["Brent Robinson"] *supra* note 164 at 25.

[169] *Madey v Duke University*, 307 F.3d 1351 (Fed Cir 2002), certiorari denied 539 U.S. 958 (2003) ["Madey cited to F.3d"].

the decision of the US Supreme Court in *Merck KGAA v Integra Lifesciences I, Ltd*[170] are described for that purpose.

The US provision in 35 U.S.C. s. 271(e)(1) of the US *Patent Act* 1790 provides that it is not an act of infringement to:

> [M]ake, use, offer to sell, or sell within the United States or import into the United States a patented invention...solely for uses reasonably related to the development and submission of information under a Federal law which regulates the manufacture, use, or sale of drugs or veterinary biological products.[171]

It is noteworthy that the statutory language of the US provision and the Canadian provision are similar. Justice Scalia of the US Supreme Court has determined the scope of the US provision in the matter of *Merck KGAA v Integra Lifesciences I, Ltd*[172] :

> [W]here a drug maker has a reasonable basis for believing that a patented compound may work, through a particular biological process, to produce a particular physiological effect, and uses the compound in research that, if successful, would be appropriate to include in a submission to the FDA, that use is "reasonably related" to the development and submission of information under...Federal Law.[173]

Despite of the obvious extent accorded to research conducted with reasonable understanding that results from experimentation with a patented compound would be appropriate for submission to the Food and Drug Authority, the court noted the applicability of the statutory exception, or rather the lack thereof, to basic research:

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[170] *Merck KGAA v Integra Lifesciences I, Ltd.*, 545 U.S. 193, 125 S.Ct. 2372 (2005) ["Merck cited to S.Ct"].

[171] *See*, 35 U.S.C. s. 271(e)(1)(1984).

[172] *Supra* note 170.

[173] *Supra* note 170 at 2383.

> [B]asic scientific research on a particular compound, performed without the intent to develop a particular drug or a reasonable belief that the compound will cause the sort of physiological effect the researcher intends to induce, is surely not "reasonably related to the development and submission of information" to the FDA.[174]

While the statutory exception discussed in *Merck* affords researchers in the pharmaceutical industry a wide use of the exception, but university researchers, particularly those conducting basic research of the kind discussed in *Merck*, are unlikely to be afforded any additional research liberties by virtue of this provision. Further in *Madey v Duke University* the scope of the common law experimental use exception in the US was significantly narrowed. Madey, a former research professor and sole patent holder of two patents related to laboratory equipment at Duke University, brought an action against the university for patent infringement contending that the continued use of three specific components of the laboratory equipment without his consent constituted infringement. Justice Gajarsa, in holding that the experimental use exception was not available to the university, stated that, the exemption was restricted to those actions conducted "for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry"[175] and that the exemption is inapplicable where the "slightest commercial implication is undertaken"[176] or where research with the patented technology is conducted under the "guise of scientific inquiry"[177] but has "definite, cognizable and not

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[174] *Ibid* at 2382.

[175] *See* ["Madey"] *supra* note 169 at 1362, quoting *Embrex, Inc v Service Engineering Corp.*, 216 F.3d 1343 (Fed Cir 2000).

[176] *See* ["Madey"] *supra* note 169 at 1362.

[177] *See* ["Madey"] *supra* note 169 at 1362, quoting *Roche Products, Inc v Bolar Pharmaceutical Co., Inc.*, 733 F. 2d 858 (Fed Cir 1984) at 863.

insubstantial commercial purposes."[178] Even more importantly and of particular relevance to the university sector, the Court found that a lack of direct commercial applicability from the use was not determinative of the exception's applicability. Therefore, if the same reasoning were applied, academic researchers in Canada may be held liable for infringement of research tool patents. From a policy perspective, the uncertain state of the research exemption in Canada results in a situation where academic researchers may not explore certain research possibilities at all. Therefore, fewer developments of products are expected to emerge if more field of research remains unexplored. An amendment to the experimental use provision in the Patent Act or a judicial pronouncement is needed to save the interest of the academic as well as the scientist researcher.

Full commercialization of academic science also sidelines the importance of educating students. Guena and Nesta mention:

> [I]f patent output is to be used in the academic evaluation process, this will create incentives for researchers to reduce their time and commitment to some of their activities – and, given the current weighting scheme, **teaching will be the activity likely to suffer the highest time reduction.**[179] [*emphasis added*]

University licensing policies have a serious bearing on the public interest. For instance, industries may approach the technology transfer office (TTO) for the purpose of exclusive licensing of the technology as further research and development needed to bring a product to market involves major investment of time and money. TTOs, being under institutional pressure to increase royalties may issue exclusive licenses in favour of industries.[180] While exclusive licensing practices may be thought of as a beneficial move

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[178] *Ibid.*

[179] *See* ["Guena and Nesta"] *supra* note 189 at 17.

from the perspective of the TTO, examples such as "the non-exclusive Cohen-Boyer patent on the recombinant DNA technology"[181] and the Canadian example of Banting and Best,[182] bear testimony to the anti-capitalistic view of innovation. Faced with a choice between collecting licensing revenue and transferring technology, TTOs may in all probability prefer an exclusive arrangement. Lemley's concurring view is expressed in terms of concerns respecting exclusive licensing and effective diffusion of new technologies:

> [F]or certain basic building blocks – "enabling technologies" – opening up licensing on many innovators who can develop different uses will generate substantial improvement, while giving an exclusive license to only one person will generate fewer improvements. And **exclusive licenses can block any development of a technology** if the licensee doesn't deliver...Exclusive licenses aren't necessarily bad...but they raise concerns about the effective diffusion of new technologies.[183] [*emphasis added*]

Academic patenting and licensing can generate significant social benefits, but blindly promoting a pro-intellectual property culture may lead to several dangerous ramifications. A restrictive intellectual property culture acts as a bar to the sharing of research results among academics. Margo Bagley mentions:

> [T]oday, academic researchers are being encouraged by technology transfer offices and industry sponsors to delay publishing and presenting their work until after filing a patent application and sometimes even longer than that while not amenable to precise quantification, the stifling of discourse and the attrition in the norms of sharing and colloquy

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[180] *See*, C. Vest, *Pursuing The Endless Frontier: Essays on MIT and the Role of Research Universities* (Cambridge: MIT Press, 2005) 205 at 206.

[181] *See*, S. Sterckx, "Patenting and Licensing of University Research: Promoting Innovation or Undermining Academic Values?" (2011) Sci Eng Ethics 51. ["Sigrid Sterckx"]

[182] *See* ["Gary Matkin"] *supra* note 78.

[183] M. Lemley, "Are Universities Patent Trolls?" (2007) Ford. IPME LJ 611. ["Lemley"]

> historically associated with the scholarly enterprise are costs that must be balanced against the technology transfer gains.[184]

Bagley further emphasizes:

> [E]ncroachment on traditional sharing norms now often comes from university intellectual property policies codified in faculty hand-books and in the instructions of TTO personnel to vet inventive work through the office before publishing or presenting it to avoid the loss of potential patent rights.[185]

The study endorses the viewpoint also emphasized by Lemley:

> [B]y even tacitly encouraging faculty to withhold key research results, university technology transfer offices may be **focusing on a red herring of commercialization, while stomping on the real goose with the golden egg – the universities' core research enterprise**.[186][*emphasis added*]

It seems that the obvious consequence of academic patenting is the suppression of research results. Some academics opine that, "universities have paid a price for industry support through excessive secrecy and corporate efforts to manipulate or suppress research results."[187] Lemley mentions:

> [U]niversity technology transfer ought to have as its goal maximizing the social impact of technology, not merely maximizing the university's licensing revenue. A university…is a public regarding institution that

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[184] *See*, M. Bagley, "Academic discourse and proprietory rights: Putting patents in their proper place" (2006) 47 BCL Rev at 2, 3.

[185] *Ibid* at 12.

[186] *See* ["Lemley"] *supra* note 183 at 6.

[187] *See*, D. Bok, *Universities in the Marketplace: The Commercialization of Higher Education* (Princeton, NJ: Princeton University Press, 2003) at 77; *See* also, ["Margo Bagley"] *supra* note 184 at 7, noting that, "Derek Bok, former Harvard University President forewarns regarding the loss of scientific integrity that comes with increased commercial ties. Bok attributes the commercialization of academia to a loss of academic values and direction, in addition to the loss of state and federal appropriations and the shift to the knowledge-based economy"; *See*, S. Hansen *et al*, *The Effects of Patenting in the AAAS Scientific Community* (Washington, D.C: AAAS, 2005) online: American Association for the Advancement of Science < http://sippi.aaas.org/survey/AAAS_IP_Survey_Report.pdf> at 5 (last accessed on June 12, 2011) ["The Effects"].

> should be advancing the development and spread of knowledge and the beneficial use of that knowledge.[188]

University policies are also determiners of the direction in which academic and scientific research is directed. For instance, research grants may be re-directed from basic to applied sciences.[189] Special emphasis on commercial and entrepreneurial research criteria may also influence the criteria for hiring academic staff.[190] Another consequence of industry funding is the increased pressure to commercialize research results. In order to increase the commercial value and appeal of research results, researchers are prone to adopting a patent friendly format of presentation. A patent friendly format refers to disclosure of the details of the claimed invention only in the complete patent specification and not prior disclosure by means of academic publication or exchange of information between peers.

A series of studies on the practice of data withholding, especially in the field of genetics and other life sciences have concluded:

> [D]ata withholding is likely to remain prevalent in academic science. One of the main obstacles is the growing commercialization of US universities [...] In 2002, more patents on genetic tests were held by universities than by companies.[191]

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[188] *See* ["Lemley"] *supra* note 183 at 6.

[189] *See*, A. Guena and L. Nesta, "University Patenting and its Effects on Academic Research" in *SEWPS Paper no.99 Science and Technology Policy Research* (UK: University of Sussex, 2003) at 16 ["Guena and Nesta"]; *See* also, W. Powell and J. Owen-Smith, "The New World of Knowledge Production in the Life Sciences" in S. Brint ed., *The Future of the City of Intellect: The Changing American University* (Stanford: Stanford University Press, 2002) at 124 ["Powell and Owen-Smith"].

[190] *See* ["Geiger and Sa"] *supra* note 50 at 178, 180.

[191] *See* for example, D. Blumenthal *et al.*, "Data Witholding in Genetics and the Other Life Sciences: Prevalence and Predictors" (2006) 81:2 Academic Medicine 137 at 145.

Adopting a proprietary attitude towards research is clearly a deviation from the Mertonian norm of disinterestedness and communalism.[192] For fulfilling the aims of commercialization, every invention generated from the research result ought to be a consequence of fate and not a result of knowledge sharing. McSherry emphasizes the lawyer's perspective on similar lines while quoting an interviewee from a TTO:

> [Attorneys] prefer that you make every invention by accident...What the patent attorney's trying to do is establish that there's no mechanism, [that] you couldn't have foreseen this. This is the exact opposite of the faculty inventor who's trying to establish that their understanding of the mechanism and predictability led to this discovery [...] That scares patent attorneys to death. People could say, wait a minute, you mean anybody could have formed this hypothesis based on what Professor Joe Schmoe said in this paper and that all you did was test [that idea]?[193]

Academic patenting and licensing also amounts to double taxation. The funding of the initial research comes from the taxpayers, who again pay a second time as the cost of royalty payments to universities is reflected in the prices of patented products and processes.[194] Therefore, academic patenting leads to excessive taxation as well. Commercialization of academia can prove unfavourable to the researcher, the innovator as well as the consumer.

3.4 Summary

Safeguarding the enterprise of "knowledge sharing" is important for ensuring scientific progress and technological development. Patents which grant the exclusive right

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[192] *See* ["Merton"] *supra* note 64 at 273.

[193] *See* also, C. McSherry, *Who Owns Academic Work?* (Cambridge, MA: Harvard University Press, 2001) at 174 ["McSherry"]

[194] *See* ["Sigrid Sterckx"] *supra* note 181 at 6; *See* also, ["Ritchie de Larena"] *supra* note at 1373; *See* also, J. Washburn, *University Inc. The Corporate Corruption of Higher Education* (New York: Basic Books, 2005).

of use to the inventor are thought of as tools which withhold knowledge and hinder innovation. Both US and Canada have taken measures by framing policies and enacting laws for allowing public research organisations such as universities and research institutes to take title to resulting inventions. The rationale behind such measures is to shift the responsibility of commercialization on to the public research organisations. The problems of bureaucracy prevent substantial interaction between the government and industry for the purposes of commercialisation. The university ownership scheme will prove to be a preferred option for increased industry interaction. The aim is to ensure that inventions resulting from publicly funded research is eventually commercialised and brought from the laboratory to the market for the benefit of the consumers. The faculty scientists involved in developing inventions are provided with incentives of shares in the revenue generated from licensing the research results.

The *US Bayh Dole Act 1980* and the Canadian measures for commercialisation of public funded research indicate that the governments are in favour of universities developing intellectual property portfolios and generating revenue through licensing. The revenue generated is further shared between the university, the inventor and other stakeholders in accordance with the terms and conditions of the university intellectual property policy. Analysis of the statistical data and studies indicate that the commercialisation strategy adopted by the Governments is not resulting in the desired revenue or university income. The income-expenditure analysis of the Statistics Canada 2008 data indicate that the cost of generating the revenue is too high for the universities and that there may be no value in intellectual property commercialization strategy for universities after all. The sample indicating the revenue sharing policies of eight Canadian universities illustrated in Table 3 explain that only a small percentage of the

income earned by the universities is reinvested in research and that too in only very few universities. Consequently, the university mission to serve the public interest seems to be blurring with the increased effort to patent even basic research tools. Patenting basic resource material hinders access to such material as it creates the "tragedy of anti-commons" and stifles scientific progress. Furthermore, the lack of clarity in statutory research exemptions in countries like Canada worsens the situation by disallowing scientists to use basic scientific findings to build upon and innovate.

There are several drawbacks to adopting a proprietary attitude towards research. The core enterprise of a publicly funded non-profit organisation is research, adopting ways to stifle innovation by suppressing access to basic research results or royalty stacking is against the idea of "knowledge sharing" and must be frowned upon.

Chapter 4

4. Technology Transfer: An International Viewpoint

> [M]ultinational Corporations are profoundly troubled by the provisions for technology transfer, which essentially mean surrendering the heretofore exclusive patents and trade secrets of advanced technology to competitors in the Third World. Much of this apprehension derives from a novel but intensely held perspective; the popular image of the world is no longer an infinitely expanding organism but rather a claustrophobic spaceship with limited and increasingly overtaxed resources, distributed hereafter to the winners of zero-sum competitions (your win is my loss).[195]
>
> - W. Michael Reisman

The cogent resonance of Michael Reisman's words reflects the transformation by a new perspective brought by technology transfer at the international context. It was as early as the 1960s, which saw the advent of the New International Economic Order (NIEO), when issues pertaining to technology transfer emerged as a controversial yet main aspect of international relations. Sifting through the pages of history, the various efforts made by the developing countries to put an international legal framework for governing technology transfer in place is noteworthy. The efforts imply that there are various perspectives regarding the need for a legal framework for governing technology transfer at the international level. This chapter seeks to analyse provisions relating to technology transfer in two international framework treaties and identify the points of tension between access and transfer of technology at the international level.

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[195] *See*, M. Reisman, "Trade Helps the Traders – The Third World's Fading Dream," The Nation, (1976) at 718, *quoted from*, P. Nanyenya-Takirambudde, *Technology Transfer and International Law* (New York: Praeger Publishers, 1980) at 76.

Since the adoption of the resolution for the establishment of NIEO,[196] the developing countries consolidated an agenda for the reform of international law that had been gaining momentum since the end of World War II. Three main changes to the international order in the postwar era laid the foundation of this momentum: first, the "massive expansion of international organization for cooperative purposes"; second, the "growing importance of states representing non-Western civilizations" in the wake of decolonization and independence movements; and third, "the growing gap between the economically developed and the economically less developed countries."[197] Post World War II, rules for the international economy provided by the Bretton Woods institutions prescribed the adoption of a *laissez-faire* stance towards internal economic growth and towards cooperation between the domestic and the international economies.[198] The developing countries resisted the substantive policies of the Bretton Woods institutions and looked to the United Nations (UN) as an alternative forum for international rule-making. Thus United Nations Conference on Trade and Development (UNCTAD) and the NIEO were formed in 1964.[199] The Preamble to the Declaration of the NIEO proclaimed:

> A united determination to work urgently for the establishment of a new international economic order based on equity, common interest and cooperation among all States which shall correct inequalities and redress existing injustices, make it possible to eliminate the widening gap between the developed and developing countries and ensure steadily

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[196] G.A. Res, 3202, U.N. GAOR, 6th Spec. Sess., 2229th mtg., Supp. No. 1 at 5, U.N. Doc. A9559 (1974).

[197] W. G. Friedman, *Cases and Materials on International Law* (Columbia: West Publishing Co, 1969) at 9, 10.

[198] *See*, C. Thomas, "Transfer of Technology in the Contemporary International Order" (1998) 22 Fordham Intl L. J. 2105.

[199] *See*, T. Kabiraj, "Intellectual Property Rights, TRIPs and Technology Transfer" (1994) 29 Economic and Political Weekly at 2990, noting that, "[t]he industrialized economies had for long been dominant in the international scene. In the post-second world war period the developing economies organized themselves as the Group of 77 (G-77) and initiated in the UN and in UNCTAD a wide series of negotiations with the West and aimed at establishing a New International Economic Order."

> accelerating economic and social development and peace and justice for present and future generations.[200]

The NIEO adopted the normative principle of "special and differential treatment for developing countries" so as to aid the process of industrialization. The NIEO further adopted a substantive principle of economic redistribution along with the institutional principle of international cooperation.[201] In the advancement of the goal to regulate foreign investment in developing countries, an "International Code of Conduct for the transfer of technology corresponding to needs and conditions prevalent in developing countries," "access on improved terms to modern technology" and the adaptation of "commercial practices governing transfer of technology" to the requirements of the developing countries was formulated under Article 4 (p) of the Programme of Action of NIEO.[202] The Draft International Code of Conduct for the transfer of technology required foreign investors to provide technical assistance by training host country personnel in the technology and not gain total proprietary control over the technology-developed as a result of joint venture with the local owners.[203] The 1980s saw the developing countries suffer growing budgetary deficits, external debt and balance of payment crises, which led to excessive borrowings from the International Monetary Fund and the World Bank. Eventually, the structural adjustment programme in the nature of negotiations for the

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[200] *Supra* note 196.

[201] *See*, D. M. Trubek, "Protectionism and Development: Time for a New Dialogue" (1993) 25 Intl Law & Policy 346.

[202] *Supra* note 196.

[203] *See*, Draft International Code of Conduct on the Transfer of Technology, United Nations Conference on Trade and Development U.N. Doc. TD/CODE TOT/33 (1981) at 21, 23.

Draft International Code suffered a stalemate[204] and the NIEO also dissolved with the onset of the debt crisis in the 1980s.[205] The developing countries adopted economic liberalization as a measure for debt relief and removed restrictions on foreign investment, including restrictions relating to technology transfer.

The Uruguay Round of Negotiations 1986 to 1994 in the General Agreement on Tariffs and Trade (GATT) was launched by the North while developing countries in the South were overcoming a debt crisis. GATT discussions had the objective of free and fair trade among its member nations and primarily limited the discussions to tariffs and trade in goods. Nonetheless, the industrialized North, especially the US, insisted on introducing issues relating to intellectual property rights within the ambit of GATT, the main contention being that ineffective protection provided to intellectual properties in countries gave rise to production and trade in counterfeit goods which led to unfair conduct and trade practices. GATT was to set standards and norms for ensuring international enforcement of trade related intellectual property rights. Opposing opinions on the aspects of the issue of intellectual property protection and patent protection in particular led the then Director General of GATT, Arthur Dunkel, to submit the draft proposal in 1991 on a 'take it or leave it' basis.[206] The draft was finally signed by the member states in 1993.

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[204] *See*, R. M. Buxbaum, "The Politico-Legal Context of the Purpose and Effect of Codification: The Example of Technology Transfer Negotiations" in N. Horn ed. *Legal Problems of Codes of Conduct for Multinational Enterprises* (London : Kluwer Law International, 1980) at 445; *See* also, T. H. Reynolds, "Clouds of Codes: The New International Economic Order Through Codes of Conduct: A Survey" (1982) 75 L. Lib. J 315; *See* also, S. Patel *et al.*, eds. *International Technology Transfer : The Origins and Aftermath of the United Nations Negotiations on a Draft Code of Conduct* (Hague: Kluwer Law International, 2001) noting that, "[d]ue to the dissension between developed countries and developing countries and changes in the world economic and political situation, the ToT Code negotiations never became an international legal document."

[205] *See*, R. Rothstein, "Epitaph for a Monument to a Failed Protest? A North-South Retrospective" (1988) 42 Intl Org at 725.

GATT had the objective of promoting free international flow of goods in trade, and with the inclusion of trade related intellectual property issues within its ambit by means of the Uruguay Round negotiations, the free international flow of ideas. Meanwhile, supporters of the TRIPS negotiations argued that protection of intellectual property was needed to permit the owners of that property to export the products that embody their innovations and hence intellectual property protection is pro-trade.[207]

4.1 Technology Transfer: A Developmental Approach

UNCTAD regarded technological change as an important source of growth in living standards and essential for modernization in developing countries.[208] Technology as a factor in international trade has time and again been emphasized as a tool for international competitiveness. The developmental levels of countries differ due to several factors. The UNCTAD acknowledges that the volume and growth of trade is explained by international technology gaps resulting in important inter-country variations in techniques used and product characteristics. Developing countries are in a disadvantageous position in terms of their socio-economic conditions of poverty, population growth and international competition. Access to innovation is seen as the only way that Least Developed Countries (LDCs) can overcome their developmental challenges. Eminent scholars noted that while developed countries had taken centuries to modernize technologically, the LDCs were expected to implement stronger intellectual property

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[206] *See* 'The Dunkel Draft' *supra* note 199 at 2990.

[207] *Ibid*; *See* also, A.V. Deardorff, "Should Patent Protection Be Extended to All Developing Countries?" (1990) 13 World Economy at 497, noting that, "[i]n an interdependent world economy with all countries being exposed to foreign trade, it is hard to isolate the one which is not trade related."

[208] *See*, J. Markusen and L. Svenson, "Trade in Goods and Factors with International Differences in Technology" (1985) 26 Intl Eco Rev at 175.

rights in a matter of decades.[209] Michael Blakeney[210] mentions that since the middle-ages in Europe the main objective for the grant of patent protection was to encourage industrial development.[211] During the 19th century, several instances were reported by the United Kingdom stating that the US refused to provide adequate intellectual property protection, as it would prevent their social and economic development. Companies in the US continued to imitate and market British innovations during this time.[212]

During the 1990s, the Uruguay Round negotiations led to the adoption of the TRIPS agreement. TRIPS brought the perception that technology transfer was the way by which LDCs could acquire foreign technology and scientific knowledge from developed countries than innovating them on their own. Such transfer was intended to initiate a process of economic development for the LDCs. Given that most of the advanced knowledge and technologies were developed and located in the North, it is thought that the LDCs would benefit from this advanced knowledge and experience and reduce the development gap *vis-à-vis* the advanced nations.[213]

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[209] *See*, K. E. Maskus, "Using the International Trading System to Foster Technology Transfer for Economic Development" 2005 Mich. St. L. Rev 219 ["Maskus"]; *See* also, J.T. Tsai, "Article: Not Tripping Over the Pebbles: Focusing on Overlooked TRIPS Article 66 for Technology Transfer to Solve Africa's AIDS Crisis" (2007) 11 Mich. St. J. Med & Law 447.

[210] *See*, M. Blakeney, *Legal Aspects of the Transfer of Technology to Developing Countries* (United Kingdom : ESC Publishing Ltd, Oxford, 1989) at 49.

[211] *Ibid*; *See* also, D. W. Kariodimedjo, "Legal Perspective of Transfer of Technology and Development in Developing Countries," *Research Paper on the Government Regulation of International Trade* (Melbourne: Monash University, 2003) at 60, noting that, "[s]ome developed countries which are home of some of the most innovative companies such as France, Germany, Italy, Japan, Sweden and Switzerland resisted providing patents until their industries had reached a certain degree of development."

[212] *See*, W. Pretorious, "TRIPS and Developing Countries: How Level is the Playing Field?" in P. Drahos and R. Mayne eds. *Global Intellectual Property Rights: Knowledge, Access and Development* (Oxfam: Palgrave MacMillan, 2002) at 183.

[213] *Ibid.*

Supposedly, the protection and enforcement of intellectual property rights was expected to contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare and to a balance of rights and obligations. Parties, in formulating or amending their national laws and regulations, were to adopt measures necessary to protect public health and nutrition, and promote public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of the TRIPS Agreement.[214]

The TRIPS Agreement aimed at benefitting the technologically poor countries in the new international set up. Countries deficient in R&D have raised concerns regarding international intellectual property protection in pharmaceuticals, food and agricultural products that are likely to primarily affect the poor.[215] Consider, for instance, the case when the Brasilian government and American laboratories entered into negotiations for reduction of drug prices in 2005. Brasil had fore-warned that it would issue a compulsory license over certain antiretrovirals (ARV). The spokesperson for the pharmaceutical industry replied that such action would "ensure that companies whose patents are destroyed will not be selling their next generation AIDS drugs, or any other medication

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[214] *See* ["Maskus"] *supra* note 209 at 220.

[215] *See*, M. Kruger, "Harmonizing TRIPS and the CBD; A Proposal From India" (2001) 10 Minn J. Global Trade 169, stating that, " [b]y contrast, developing countries like India stand to lose the most from strong intellectual property protection, because with strong IP protection they lose access to affordable medicines, crop chemicals and educational materials." ["Kruger"]; *See* also, F. Emmert, "Intellectual Property In the Uruguay Round – Negotiating Strategies of the Western Industrialised Countries" (1990) 11 Mich J Intl L 1317 at 1383, stating that, " [f]armers, students and the sick rely on cheap access to seeds, education and drugs for their basic way of life" and discussing the particular importance of protecting access to advances in education, agricultural materials and medicines to newly industrialised countries.

for that matter in Brazil."[216] Such instances lead one to question, whether TRIPS endangers the transfer of technologies required by developing countries for their sustainable development. The following section discusses the provisions pertaining to technology transfer in the TRIPS Agreement to establish conclusions regarding the effect of monopolizing technology.

4.2 TRIPS and Technology Transfer

The key objective of the WTO is to promote trade and economic development.[217] The TRIPS Agreement has several provisions directly relating to the issue of international technology transfer. The most important among them are the Preamble, Articles 7, 8, 66.2 and 67. The first recital of the Preamble to the TRIPS Agreement indicates that its principal objective, which is to reduce distortions and impediments to international trade, is international technology transfer promotion. The minimum standards provided by the TRIPS Agreement are a means to achieve this principal objective. The fifth recital of the Preamble recognizes the underlying public policy objectives of national systems for the protection of intellectual property, including developmental and technological objectives. The sixth recital of the Preamble to TRIPS makes explicit mention of the special needs of least developed economies regarding implementation:

> [R]ecognizing also the needs of the least-developed country members in respect of maximum flexibility in the domestic implementation of laws and regulations in order to enable them to create a sound and viable technological base.[218]

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[216] *See* also, B. Salama and D. Benoliel, "Pharmaceutical Patent Bargains: The Brazilian Experience" (2010) 18 Cardozo J Intl & Comp L at 656.

[217] *See, Preamble to the Marrakesh Agreement Establishing the WTO* online : www.wto.org (last accessed on January 12, 2011).

Thus the Preamble indirectly encourages technology transfer. The objectives of the Agreement in Article 7 of TRIPS also confirm and recognize, in rather unspecific terms, the importance of technology transfer as a benefit of intellectual property rights:

> [T]he protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the **transfer and dissemination of technology**, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligation.[219] [*emphasis added*]

Though Article 7 does not impose any specific obligation on developed countries, it demonstrates the overall importance of international technology transfer to TRIPS. The TRIPS review processes in general require the development of an intellectual property policy capacity on the part of LDCs as members of the WTO. Furthermore, other provisions could be read in light of their requiring developed countries to help ensure that the adoption of intellectual property rights does indeed contribute to innovation, transfer, and dissemination of technology in LDCs.

Additionally, Article 8 establishes principles in favour of transfer and dissemination of technology. Article 8.1 indicates that WTO Members may, in formulating or amending their law and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interests in sectors of vital importance to their socio-economic and technological development provided that such measures are consistent with the Agreement. Article 8.2 recognizes the need to take appropriate measures to prevent resorting to practices which adversely affect the

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[218] "Preamble" Agreement on Trade-Related Aspects of Intellectual Property Rights, April 15, 1994, 33 I.L.M. 1197 ["TRIPS"], Annex 1C of Legal Instruments—Results of the Uruguay Round of Multilateral Trade Negotiations, April 15, 1994, 33 I.L.M. 1197 (1994).

[219] *Ibid* at Art 7.

international transfer of technology. Articles 66.2 and 67 impose more clear and direct obligations on developed countries with regard to assistance and technology transfer to LDCs.

Article 66.2 provides:

> [D]eveloped country members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country members in order to enable them to create a sound and viable technological base.[220]

The negotiating history of Article 66.2 suggests that it was a "last-minute attempt by developing countries to rebalance the final [agreement]," and that industrialised countries were not keen on it and "succeeded in limiting its scope to LDCs only."[221] Article 67 explicitly addresses measures to promote technology transfer to LDCs by establishing workable systems of intellectual property protection within LDCs.

The Article provides:

> [I]n order to facilitate the implementation of this Agreement, developed country members shall provide on request and on mutually agreed terms and conditions, technical and financial cooperation in favour of developing and least-developed country members. Such cooperation shall include assistance in the preparation of laws and regulations on the protection and enforcement of intellectual property rights as well as on the prevention of their abuse, and shall include support regarding the

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[220] *Id.* at Art 66.2.

[221] *See*, D. Gervais, *The TRIPS Agreement: Drafting History and Analysis* (London: Sweet and Maxwell, 2003) at 3, 24; *See*, P. Roffe, "Comment: Technology Transfer on the International Agenda" in K. E. Maskus & J. H. Reichman eds. *International Public Goods and Transfer of Technology Under a Globalized Intellectual Property Regime* (United Kingdom: Cambridge University Press, 2005) at 263; *See* also, A. Michaels, "International Technology Transfer and TRIPS Article 66.2: Can Global Administrative Law Help Least-Developed Countries Get What They Bargained For?" (2009) 41 GJIL 223; *See* also, S. K. Sell, "Intellectual Property & Trade: The Quest for TRIPS and Post-TRIPS Strategies" (2002) 10 Cardozo J. Intl & Comp. L at 79 ["Sell"]; *See*, C. M. Correa, "Can the TRIPS Agreement Foster Technology Transfer to Developing Countries?" in K. E. Maskus and J. H. Reichman eds. *International Public Goods and Transfer of Technology Under a Globalized Intellectual Property Regime* (UK: Cambridge University Press, 2005) at 227.

> establishment or reinforcement of domestic offices and agencies relevant to these matters including the training of personnel.[222]

Measures taken by developing countries to comply with Article 67, such as holding classes to train government administrators in the intricacies of intellectual property rights, could also be said to count towards implementation of Article 66.2. Intellectual property rights can be one factor leading to increased private international technology transfer in countries with relatively good investment climates. The interpretation of the provisions pertaining to technology transfer in the TRIPS agreement provide for a developmental approach in contrast to total privatisation of technology. Technology transfer is perceived as a tool for economies to strengthen a level playing field by promoting technological innovation, transfer and dissemination of technology. Accepting that the above provisions of the TRIPS Agreement encourage and promote technology transfer, one essential concern is whether international technology transfer, especially the technology transfer from the developed countries to the LDCs, actually exists. Intellectual property protection merely provides a platform for technology transfer but does not guarantee the transfer in practice. The developed countries prompted the negotiation of the TRIPS Agreement based on the argument that an expanded and strengthened protection of intellectual property would bring about increased flows of foreign direct investment (FDI) and technology transfer to developing countries and that change in intellectual property would also stimulate local innovation.[223] In spite of the adoption of the TRIPS Agreement, the North-South technological gap has continued to

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[222] *See* ["TRIPS"] *supra* note 218, Art 67.

[223] *See*, C. M. Correa, "Review of the TRIPS Agreement: Fostering the Transfer of Technology to Developing Countries" (2000) TWN online http://www. twnside.org.sg/title/foster.htm (last accessed on June 12, 2011).

grow.[224] Several developing countries have raised concerns that the enhanced protection given to intellectual property will impede the development process and restrict the access to technology.[225] Intellectual property rights, patents in particular, are a result of the corporate concentration and consolidation of the multinational companies (MNCs). The life sciences industry which witnessed several mergers of MNCs in the 1990s is an apt example of the relatedness of intellectual property rights and the TRIPS Agreement. Commercial sale of seeds, pesticides, food and pharmaceuticals are controlled by small number of MNCs. According to estimates indicated in the United Nation Development Program's Human Development Report, 1999, in the year 1998, the top ten corporations in the commercial seed industry controlled 32% of the US$23 billion industry; in pharmaceuticals, 35% of the US$297 billion industry; in veterinary medicine, 60% of the US$17 billion industry; and in pesticides 85% of the US$31 billion industry.

Corporate control over the supply of the products consequently leads to control over the price of the products. Monopolistic tendencies drive MNCs to increase the price of essential goods. Aside from the pricing issue, control over essential resources such as seeds, drugs and food translate into the MNCs having control over fundamental rights of access to food, health and nutrition. The TRIPS Agreement imposes obligations on the WTO members to make substantial changes to the national laws to afford protection for

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[224] *See*, L. Helfer, "Regime Shifting: The TRIPS Agreement and New Dynamics of International Intellectual Property Law-making" (2001) 29 Yale J Intl L at 23 ["Helfer- Regime Shifting"].

[225] *See*, M. Kruger, "Harmonizing TRIPS and the CBD; A Proposal From India" (2001) 10 Minn J Global Trade 169, stating that, "[b]y contrast, developing countries like India stand to lose the most from strong intellectual property protection, because with strong IP protection they lose access to affordable medicines, crop chemicals and educational materials." ["Kruger"]; *See* also, F. Emmert, "Intellectual Property In the Uruguay Round – Negotiating Strategies of the Western Industrialised Countries" (1990) 11 Mich J Intl L 1317 at 1383, stating that, "[f]armers, students and the sick rely on cheap access to seeds, education and drugs for their basic way of life" and discussing the particular importance of protecting access to advances in education, agricultural materials and medicines to newly industrialised countries; *See* also, Dru-Brenner-Beck, "Do As I Say, Not As I Did" (1992) 11 UCLA Pac Basin LJ 84, stating that, "[l]esser developed countries do not benefit from IPR systems until they have reached a threshold level of development."

the inventions and technologies generated by the MNCs. There are elaborate enforcement procedures in the Agreement, which are backed by a right for the complaining country to apply for cross-retaliations against a non-complying country. The TRIPS agreement as such does no more than emphasize the need for a developmental approach by means of technology transfer in favour of the LDCs so as to uplift their socio-economic status.

4.3 Challenges to the Developmental Approach: Barriers to Access and Transfer

The LDCs were promised technology transfer as a tool for their socio-economic emancipation and development. The development of socio-economic status is closely associated to the nature of problems faced by countries in need of technological aid. The common concerns of the developing countries in the nature of increasing population, poverty, food insecurity and health bring to the fore issues relating to inadequate access to bio-based technology and generic resources. Access to innovation and technology become a crucial aspect closely connected to survival than merely trade.[226]

Under the United Nation's Convention on Biological Diversity, 1992 (CBD), relevant technologies are identified as means of achieving the objectives of conservation and sustainable use. Scholars have emphasized that "technology transfer is the means of providing broad access in an interdependent world."[227] There are many relevant

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[226] *See generally*, L. Imade, "The Two Faces of Globalization: Impoverishment or Prosperity" (2003) Intl Studies Center, online http://globalization.icaap.org/content/v3.1/01_imade.html (last accessed on January 12, 2011); *See* also, W. Lesser, "Role of Intellectual Property Rights in Biotechnology Transfer under the Convention on Biological Diversity" in *The International Service for the Acquisition of Agri-biotech Applications Briefs No. 3* (Ithaca, NY : ISAAA Briefs, 1997) at 22 ["Lesser"]; For a detailed discussion on access to development goals, *see generally*, L. Sebastian and J. Payumo, "Implications of the Treaties TRIPS, CBD and ITPGRFA on Public Agricultural R&D in the Philippines" (2008) 91 The Philippine Agricultural Scientist at 228, noting that, "[t]he knowledge and products from agbiotech research could largely contribute towards the attainment of the United Nations' Millennium Development Goals of eradicating hunger and poverty."

[227] *See* ["Lesser"] *supra* note 226 at 25.

technologies which are likely to be protected by intellectual property rights, such that the recognition of those rights become an aspect of technology transfer which can draw specific connection to the objectives of the Convention. Intellectual property rights bear specific importance in this light.

From the previous instances discussed, this study finds that international policy in the area of technology transfer is driven by the developed North. It is suggested that in order to safeguard the interests of the South, a global economic and sustainable development model for technology transfer needs to be implemented.

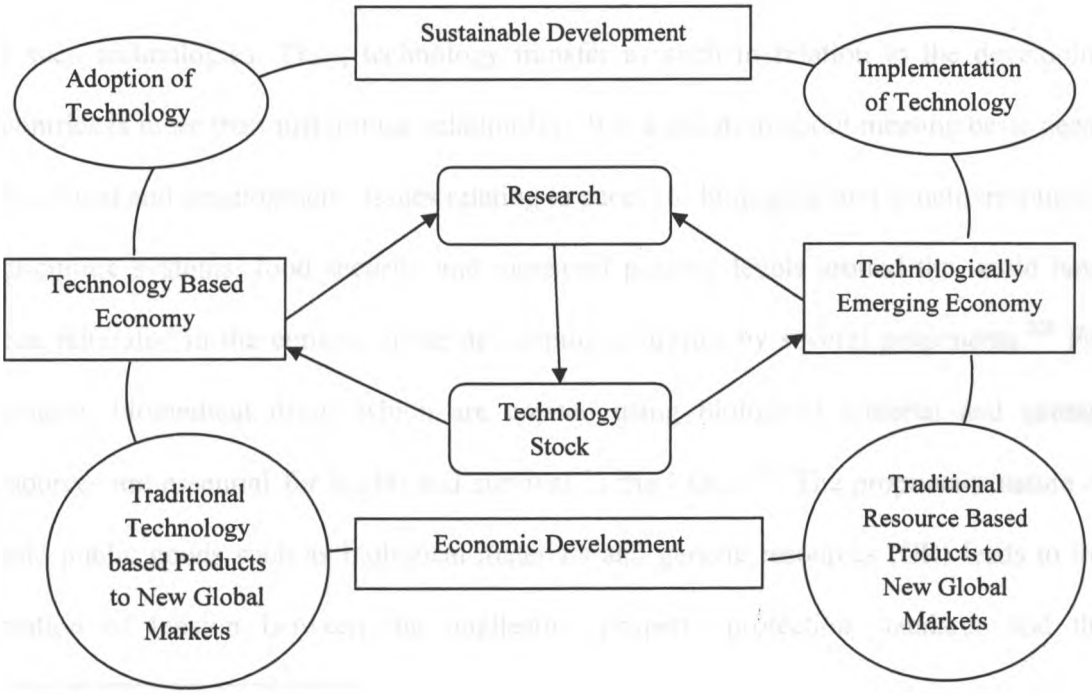

Figure 5: Model for Economic & Sustainable Development

Figure 5 illustrates the interdependent link between the holders and receivers of technology. For the purpose of economic development, traditional technology-based products are sent to the global market by a technology-based economy, while for the purpose of sustainable development, the traditional resource based products

are sent to new global markets. The two parties i.e., the resource donor providing the material and the resource recipient are to achieve the goal of sustainable and economic development. The two international treaties negotiated during the 1990s, which set standards and rules involving intellectual property rights and access and transfer of resources essential for innovation and research are the TRIPS Agreement, 1995 and the Convention on Biodiversity, 1992 (CBD).

The application of intellectual property rights especially to bio-based technology, have particularly important implications to access, availability and transfer of such technologies. Thus, technology transfer as such in relation to the developing countries is more than just a trade relationship. It is a question about meeting basic needs of survival and development. Issues relating to access to biological and genetic resources, agriculture systems, food security and increased poverty levels around the world have been reiterated in the context of the developing countries by several proponents.[228] For instance, biomedical drugs which are created using biological material and genetic resources are essential for health and survival in the LDCs.[229] The proprietary nature of basic public goods such as biological materials and genetic resources (GR) leads to the creation of tension between the intellectual property protection standards and the

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[228] *See*, C. L. Diaz, *Intellectual Property and Biological Resources – An Overview of Key Issues and Current Debates* (Wuppertal : Wuppertal Institute for Climate, Environment and Energy, 2005) at 120; *See* also, U. Schuklenk and A. Kleinsmidt, "North-South Benefit Sharing Arrangements in Bioprospecting and Genetic Research : A Critical Legal and Ethical Analysis" (2006) 6:3 Developing World Bioethics 122 at 133; *See* generally, W. Reid *et al.*, "A New Lease on Life", in *Biodiversity Prospecting: Using Genetic Resources for Sustainable Development* (Baltimore, MD : WRI, 1993) at 6.

[229] *See*, UN Study, "Overcoming Barriers to Access" online: http://www.unmillenniumproject.org/documents/TF5-medicines-Chapter2.pdf (last accessed on January 12, 2011); *See* also, T. Ensor and S. Cooper, "Overcoming Barriers to Health Service Access and Influencing the Demand Side through Purchasing" (2004) HNP online: http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1095698140167/EnsorOvercomingBarriersFinal.pdf (last accessed on January 12, 2011).

principles and rules of other international regimes which are directly devoted towards the concerns of the developing economies.[230]

The following section explores the synergies and conflicts pertaining to technology transfer in TRIPS and CBD to highlight the divergent approaches to the enterprise of "knowledge sharing" discussed in Chapter 3.

4.4 CBD and TRIPS: Identifying the relationship

The primary objectives of the TRIPS Agreement involve the reduction of hindrances to international trade by promoting effective and adequate intellectual property right protection, promotion of technological innovation, the transfer and dissemination of technology under a relationship of mutual advantage to producers and users of such technology, conducive to social and economic welfare, balanced rights and obligations. Global minimum standards for the protection of intellectual property rights including plant genetic resources established due to the TRIPS regime fundamentally changed international intellectual property law.[231]

An examination of the negotiating history of TRIPS shows that it was "drawn up with the encouragement and active support of large corporations to promote their technological dominance and gain additional margins of profit through obtaining private

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[230] *See* ["Helfer - Regime Shifting"] *supra* note 224 at 23.

[231] *See*, K. Nnadozie and R. Lettington, *International Treaties of Relevance to Plant Genetic Resources for Food and Agriculture* (Washington, D.C: Meridien Institute, 2003) at 24, online: Meridien Institute http://www2.merid.org/bellagio/Intl_Treaties_Paper_FINAL.pdf (last accessed on March 12, 2011) for a discussion of International instruments and issues of access to PGRs.

monopolies."[232] Countries such as the US have favoured the intellectual property right model within the TRIPS framework. The intellectual property right model is synonymous with the "corporate" model and favours the rights and benefits of intellectual property right holders. Being a commercial treaty, TRIPS incorporates commercial objectives to largely benefit private firms. Social causes such as human development, conservation of resources and environmental protection feature only in terms of references to or exemptions made on behalf of the environment, human and animal health and public order.[233] On the other hand, establishment of international treaties such as the CBD were a result of the growing concern about the rapid worldwide loss of biodiversity and essential resources. Rights of local communities and indigenous people who are recognised as holding the key to biodiversity conservation and use also form an important aspect of the Treaty.[234] Unlike TRIPS, the promotion of commercial interests is not central to the objectives of the CBD. One of CBD's central aspects is the recognition of the need to regulate the behaviour and effects of private corporations and researchers. It aims to constrain their rights of access and benefits within a larger framework that stresses the goals of environmental protection and the rights of sovereign states to their

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[232] *See*, K. Maskus and M. Penubarti, "How Trade Related Are Intellectual Property Rights?" (1995) 39 J.Intl. Eco. 227-248 (online) http://www.elsevier.com/locate/inca/505552 (last accessed on March 12, 2011).

[233] *See* for instance, Art 27.2 of the TRIPS Agreement which deals with 'Patentable Subject Matter' provides, "Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre* public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law." *See* also, G. Dinwoodie and R. Dreyfuss, "International Intellectual Property Law and the Public Domain of Science" (2004) 7 J Intl Econ L. 431, 435, noting that, "[t]here are no WTO decisions addressing Article 27 subject matter exclusions directly, but relying on the WTO's tendency to hew closely to the text when resolving disputes." ["Dinwoodie & Dreyfuss"].

[234] *See*, M. Khor, *Intellectual Property, Biodiversity and Sustainable Development: Resolving The Difficult Issues* (Penang, Malaysia: Third World Network, 2002) at 55. ["Khor"]

resources and the rights of local communities within them.[235] Supporters that argue in favour of TRIPS Agreement hold that strong protection of intellectual property rights encourages creation and innovation.[236] The essential contention being that the justification for intellectual property rights was to encourage artistic creation and innovation.[237] Effective administration of intellectual property rights will maximise the contributions of inventors.[238] There are other proponents that contend that weak protection of intellectual property rights protects life itself by ensuring access to essential goods for medical treatment, sustenance and development.[239] Graham Dutfield identifies three realms of incompatibility between the CBD and the TRIPS Agreement. They are "pro-patent," "anti-patent" and the "pragmatic" viewpoints.[240] Essentially, the pro-patent view is that a strong patent regime is supportive of the objectives of CBD. Corporations would be willing to invest in natural product research and more likely to participate in benefit sharing and technology transfer agreements, that is, strong intellectual property rights will provide incentive to the careful preservation of these valuable resources. The anti-patent view asserts that by creating patents over living organisms, the destruction of biodiversity is encouraged, and monopolies that are unfair and immoral are created. The

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[235] *Ibid.*

[236] *See*, M. W. Smith, "Bringing Developing Countries Intellectual Property Laws to TRIPS Standards: Hurdles and Pitfalls Facing Vietnam Efforts to Normalize an Intellectual Regime" (1999) 31 Case W Res J Intl L 211 at 215 ["Smith"]; *See* also, R. M. Sherwood, *et al.*, "Promotion of Inventiveness in Developing Countries Through a More Advanced Patent Administration" (1999) 39 IDEA, 473, suggesting that, " [e]ffective administration of intellectual property rights will maximise the contributions of inventors." ["Sherwood"].

[237] *See* ["Smith"] *supra* note 236 at 215.

[238] *See* ["Sherwood"] *supra* note 236 at 473.

[239] *See* ["Kruger"] *supra* note 215 at 169.

[240] *See*, G. Dutfield, *Intellectual Property Rights, Trade and Biodiversity: Seeds and Plant Varieties* (UK: Earthscan Publications, 2000) at 41.

anti-patent view holds that such patents support biopiracy, which is the unauthorised use of biological resources or the knowledge held by indigenous communities of developing countries. The pragmatic view is that while there are difficulties in reconciling the incompatibilities between TRIPS and CBD, the best way to achieve reconciliation is through amendments and additions to the existing systems of intellectual property right protection. The following sections explain the conflicts between TRIPS and the CBD in terms of implementation of technology transfer.

The Convention on Biodiversity (CBD) was drafted at the Rio Earth Summit in 1992 and came into effect in 1993. CBD is dedicated to promoting sustainable development and addressing problems associated with the exchange and use of plant genetic resources. The TRIPS Agreement and the Biodiversity Convention were developed at the same time, by different delegations with different objectives, and with almost no consultation or even communication between the two negotiations.[241]

The effects of a strong intellectual property right regime on technology transfer, particularly biotechnology, can be assessed in light of the objectives of the CBD. Article 1 of CBD provides for an important legal objective. The Article states:

> [T]he conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of GR, including by appropriate access to GR and by **appropriate transfer of relevant technologies** taking into account all rights over those resources and to technologies and by appropriate funding.[242] [*emphasis added*]

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[241] *See*, A. Boyle and P. Birnie, *International Law and The Environment*, 2ed. (New York: Oxford University Press, 2002) at 732.

[242] *See*, Art 1 "Objectives" Convention on Biodiversity CBD (1992): International Legal Materials, Vol 31, No. 4, July 1992 online http://www.biodiv.org/convention/articles.asp?lg=0 (last accessed on January 12, 2011.)

The Convention has mainly three objectives: conservation of biological diversity, which could be the activity of technology transfer itself; sustainable use of its components, which are its indirect effects such as implications for labour requirements; and fair and equitable sharing of the benefits arising out of the utilization of GR, which are the equity considerations for the providers or innovators.

Taking a practical view of technology, CBD views it as one possible means of achieving stated objectives. In other words, technology transfer features as a method for achieving one of the three principal objectives of CBD, and intellectual property rights are identified as the significant aspect of technology transfer. Technology transfer is also presented as a means of achieving the rights of traditional and indigenous peoples. Benefit sharing from the use of genetic resources is defined to include *inter alia*, "the appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies."[243] In essence, CBD recognizes that the conservation of biological diversity is a common concern of humankind and promotes national sovereignty of genetic resources and sharing of benefits.[244] The term biodiversity as put forward in the CBD means the "variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other marine ecosystems and the ecological challenges of which they are part of, which includes diversity within species and of ecosystems."[245]

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[243] *Ibid.*

[244] *See*, Convention on Biodiversity, online: http://www.biodiv.org/default.shtml (last accessed on January 12, 2011) ["CBD"]; *See* also, Convention on Biodiversity, online: http://www.cbd.int/doc/legal/cbd-un-en-pdf (last accessed on January 12, 2011); *See* also, Editorial, "Genetic Benefit Sharing" (2000) 290:5489 Science 49, online : Science http://www.sciencemag.org/cgi/content/summary/290/5489/49 (last accessed on January 21, 2011), "[B]enefit sharing as an objective is designed to provide an incentive for fulfilling the other two core objectives, which are the conservation and sustainable use of genetic resources. Benefit sharing has been established as a principle of international law in the area of genetic resources in food and agriculture."

[245] *See* ["CBD"] *supra* note 244 Art 2 of CBD.

The CBD achieves these objectives in part by recognising a states' sovereign right to control genetic resources within its borders and to determine conditions of access. Therefore there are two identifiable sets of rights in respect of genetic resources in CBD. The first set of rights can be exercised over the genetic resources *per se* and the second set relates to the technologies that are based on those genetic resources. Access to these technologies may be granted only upon mutually agreed terms and subject to the prior informed consent of the state providing the resources. The sovereignty and access rules of CBD allow the biodiversity rich South to act as "gatekeepers, conditioning access by private parties seeking the genetic raw materials needed for future innovations upon a promise to provide compensation, technology transfers or other benefits should those innovations prove commercially profitable."[246] The CBD does not define what constitutes 'a benefit' nor does it lay down the criteria to determine when a benefit-sharing arrangement is "fair and equitable."[247] The conditions for access and benefit sharing are set forth in MTAs between the biological material or genetic resource providers and the commercial entities seeking access to the resources as recipients. Some authors refer to these MTAs as biodiversity prospecting contracts that create specific rights and obligations for each party.[248] While the CBD does not mention the types of benefits to be shared, it does consider access to technology and participation in research to be important

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[246] *Supra* note 224 at 31.

[247] *See*, K. Nnadozie, "Evolving Norms Of Ownership and Access: Benefit-Sharing In A Global Context" in R. Gold and B.M Knoppers eds. *Biotechnology IP and Ethics* (Canada: LexisNexis, 2009) at 244. ["Nnadozie"].

[248] *See*, L. Helfer, "Intellectual Property Rights in Plant Varieties : An Overview with Options for National Governments" (FAO Legal Papers Online No. 31, 2002), online www.fao.org/Legal/pub-e.htm (last accessed on January 12, 2011).

benefits. Article 19 of the Convention, which deals with the handling of biotechnology and distribution of its benefits, specifically provides:

> [E]ach Contracting Party shall take legislative, administrative and policy measures, as appropriate, to provide for the effective participation in biotechnological research activities by those Contracting Parties, especially developing countries, which provide the genetic resources for such research, and where feasible in such Contracting Parties.[249]

> [E]ach Contracting Party shall take all practicable measures to promote and advance priority access on a fair and equitable basis by Contracting Parties, especially developing countries, to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting Parties. Such access shall be on mutually agreed terms.[250]

Article 19 reiterates that developing countries, being providers of genetic resources, promote and advance priority access on a fair and equitable basis by parties, especially developing countries, to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting parties. The CBD is binding on over 190 member states.[251]

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[249] *See* ["CBD"] *supra* note 244, Art 19.1 of CBD.

[250] *See* ["CBD"] *supra* note 244 Art 19.2 CBD; *See* also ["Nnadozie"] *supra* note 247 at 246, "[T]he benefits shared between a provider and a user of genetic resources could be the results of research and development or of other related activities, as well as the monetary benefits derived from the utilization of the genetic resources. The CBD also points to other possible benefits that should be shared with the providing country, such as "full" and "effective" participation in scientific research and biotechnology research activities based on the genetic resources provided, especially by developing countries (Articles 15(6) and 19(1); access to and transfer of technology that uses their genetic resources to developing countries, including those protected by patents and other intellectual property rights (Article 16(3)); and priority access of providing countries, in particular developing countries, to the results and benefits derived from biotechnologies based on the genetic resources they provided (Article 19(2)))."

[251] The CBD list of parties is annexed as Appendix E at 174.

4.5 TRIPS and the CBD : Is there a conflict?

The objectives of the CBD and TRIPS are seemingly unrelated but there are several contentious issues. The statement by the G-77[252] and China noting their "deep concern that intellectual property rights deny developing countries access to affordable technology and equitable benefits that accrue from the conservation and sustainable use of biodiversity"[253] reiterate the imbalance between TRIPS and CBD. The developing countries' emphasised, "...if the Convention on Biodiversity is to have any meaning beyond superficialities, then the removal of these distortions is crucial."[254] India and Tanzania also stressed that "intellectual property rights regime and the TRIPS agreement of the WTO are detrimental to achieving the objectives of the CBD."[255]

The following section analyses the provisions pertaining to technology transfer in CBD to ascertain the tensions between the two Agreements. In terms of transfer of technology, the provisions contained in Article 16 are noteworthy. In fact, the reference to the negotiating history of CBD as explained by one of the negotiators, B.E Tewolde of

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[252] G-77 was established on June 15, 1964 by seventy-seven developing countries signatories of the Joint Declaration of the Seventy-Seven Countries issued at the end of the first session of the United Nations Conference on Trade and Development (UNCTAD) in Geneva. G-77 is the largest intergovernmental organization of developing countries in the United Nations, which provides the means for the countries of the South to articulate and promote their collective economic interests and enhance their joint negotiating capacity on all major international economic issues within the United Nations system, and promote South-South cooperation for development; *See*, online http://www.g77.org/doc/index.html (last accessed on June 12, 2011).The list of G-77 Countries is annexed as Appendix F at 176.

[253] *See* for example, Report of the First Meeting of the Conference of the Parties to the Convention on Biological Diversity, UN Environmental Programme, Conference of Parties to the Convention on Biological Diversity, *para* 98, UN Doc. UNEP/CBD/COP/1/17 (February 28, 1995).

[254] *Ibid.*

[255] *See*, Summary of the Fourth Meeting of the Conference of the Parties to the Convention on Biological Diversity: 4-15 May 1998, Earth Negotiations Bill. (Winnipeg, Canada: Intl Inst. For Sustainable Dev,1998) May 18, 1998 at 6.

Ethopia, expresses the tensions and balancing acts in relation to the provisions pertaining to technology transfer. Tewolde explains:

> [A]rticle 16 is a complex Article because it resulted from the conflicting interests of the North, which wanted to hang on to its advantages in biotechnology, particularly genetic engineering and the biodiversity rich South, which wanted technology transfer in exchange. The North insisted that technology transfer should be linked to the Northern form of IPRs in order to protect the interests of their private sectors, particularly their transnational corporations. Conversely the South wanted to make sure that IPRs do not damage the prospects for the conservation and sustainable use of its biodiversity and insisted on the inclusion of paragraph 5. This upset the USA so much that it became one of the reasons why it never ratified the Convention.[256]

Para 5 of Article 16 provides:

> [T]he Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.[257]

Article 16.5 implies that intellectual property rights can have negative effects on implementing the CBD and that contracting parties have to cooperate to ensure that intellectual property rights are supportive of and do not run counter to the CBD's objectives. The provision also includes a caveat that the cooperation be subject to national and international law.

Furthermore, Articles 16.1 and 16.2 may be read in the same light. Article 16.1 states:

> [E]ach Contracting Party, recognizing that technology includes biotechnology, and that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention, undertakes subject to the provisions of this Article to provide and or facilitate access for and transfer to other

[256] For historical reference, *see* ["Khor"] *supra* note 234 at 142.

[257] *See* ["CBD"] *supra* note 244, Art 16.5.

> Contracting Parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment.[258]

Article 16.2 provides that transfer of technology to developing countries shall be provided and facilitated under "fair and most favourable terms,[259] including on concessional and preferential terms where mutually agreed." Where technology is subject to patents and other intellectual property rights "such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights. The application of the paragraph shall be consistent with paragraphs 3, 4 and 5 below."[260]

Article 16.3 states that each contracting party shall take measures with the aim that parties, especially developing countries that provide genetic resources, are provided access to and transfer of technology which makes use of those resources, on mutually agreed terms, including technology protected by patents and other intellectual property rights, in accordance with international law and consistent with paragraphs 4 and 5. Article 16.3 of CBD addresses the issue of access and transfer of technology which makes use of genetic resources to economies, particularly developing countries which are providers of the genetic resources. The Article provides for parties to take measures to provide access to and transfer of technology on mutually agreed terms. Article 15 of CBD supports Article 16.3 by providing that sharing of results of R&D and the benefits arising from the commercial and other utilization of genetic resources should take place in a fair

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[258] *See* ["CBD"] *supra* note 244, Art 16.1.

[259] *See*, C. McManis, "Interface between International Intellectual Property And Environmental Protection: Biodiversity and Biotechnology" (1998) 76 W.U.L.Qly at 263, noting that, the terms "fair and most favourable terms" refers to "commercially reasonable and non-discriminatory."

[260] *See* ["CBD"] *supra* note 244, Art 16.2.

and equitable way and upon mutually agreed terms, with the party providing such resources. To facilitate the transfer of technology to developing countries, Articles 16.5 and 16.3 place emphasis on the obligations of developed countries with technology.

The articles are limited by the need to be consistent with international law, and through the provision in Article 16.2 that technology access and transfer shall be on terms consistent with adequate and effective protection of intellectual property rights. The provision aims at providing developing countries with access to technology on favourable and concessional terms, but the need for consistency with intellectual property rights' protection and international law counteract the obligations on technology transfer. These implications lead the aims of technology transfer on favourable terms difficult to be implemented.

Inherent in Article 16, is a basic conflict between the aims and obligations of technology transfer on preferential terms to the developing countries, and the need to recognise and be consistent with the adequate and effective protection of intellectual property rights. Furthermore, a basic conflict between Articles 16.5 and 16.2 is noteworthy. Article 16.5 recognises that patents and other intellectual property rights can influence the implementation of CBD and therefore, parties are obliged to cooperate to ensure that intellectual property rights support and not counter CBD's objectives. The obligation imposed upon the member states are subject to international law as well as the proviso to Article 16.2, which states that this obligation has to be subject to international law. The WTO TRIPS Agreement, which came into force subsequent to the CBD represents the main international law treaty regulating the effective protection of intellectual property rights. Therefore, a conflict does exist between TRIPS and the CBD

obligations on technology transfer and on cooperation to ensure that intellectual property rights do not frustrate CBD objectives.

Martin Khor in *Intellectual Property, Biodiversity and Sustainable Development: Resolving The Difficult Issues* emphasizes, that there is "an inherent tension in spirit between the aspirations of a majority of CBD parties" (i.e., developing countries) that recognise the potential adverse effect of a strict intellectual property rights regime and that are demanding effective technology transfer and access, and the insistence of developed countries that the rights of intellectual property rights holders be fully respected, irrespective of the effects on the CBD.[261]

As discussed above, the issue of access and technology transfers in CBD is closely associated with intellectual property rights. The drafters of the CBD envisioned that technology would function as a *quid pro quo* for access. Economies rich in biodiversity but poor in the skills agreed to facilitate access to genetic resources in exchange for a commitment by technology rich economies to provide and/or facilitate access for and transfer to other contracting parties of technologies in relevance to conservation and sustainable use. The CBD allows developing countries which are biodiversity rich to regulate access to their genetic resources and to share in the benefits arising from their use. Therefore, as per the CBD, the San tribe ought to be compensated by SACSIR with share in the benefits arising from the use of hoodia.

Providers of genetic resources have not been compensated or acknowledged, or otherwise have not been positioned to share in the benefits arising from the use of such resources, because genetic resources were considered to be the "common heritage of

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[261] *See* ["Khor"] *supra* note 234 at 77.

mankind"[262]and therefore free for all. The 1990s witnessed a shift in the notion from common heritage to affirming state sovereignty over the genetic resources and the right to determine the access and benefit sharing conditions.[263] Therefore within the CBD the typical notion of technology transfer dons the function of an instrument of exchange or compensation.

One may question that in case of conflict between TRIPS and CBD, which Treaty would prevail? For instance, if patents hinder the access to a particular resource or technology, will patents be seen as opposing the objectives of CBD? Some authors believe TRIPS supersedes CBD.[264] It is noteworthy that Article 22 of CBD adopts a rule of priority stating:

> [T]he provisions of this Convention shall not affect the rights and obligations of any Contracting Party deriving from any existing international agreement, except where the exercise of those rights and obligations would cause a serious damage or threat to biological diversity.[265]

Therefore the interpretation of Article 22 would require developing countries to demonstrate that patents are working against the conservation of biodiversity. However, Article 30 of the Vienna Convention on the Law of Treaties (VCLT) dictates that TRIPS

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[262] *See*, B. De Jonge and M. Korthals, "Vicissitudes of Benefit Sharing of Crop Genetic Resources : Downstream and Upstream" (2006) 6:3 Developing World Bioethics 144, ["Jonge and Korthals"]; *See* also, J. Kloppenburg, *First The Seed: The Political Economy of Plant Biotechnology* (Cambridge, UK : Cambridge University Press, 1988), noting that, "[t]he principles of common heritage and free exchange had sent the developing world an ironic message: although the genetic material located within their borders is of great potential value, these resources, until transformed by technological invention or intervention, are a public good that can be freely appropriated." ["Kloppenburg"].

[263] *See* ["Kloppenburg"] *supra* note 262 at 249.

[264] *See* generally, C. McDougall, *Intellectual Property Rights and the Biodiversity Convention: the Impact of GATT* (United Kingdom: Friends of the Earth, 1995), noting that, "CBD cannot require technology transfer over and above that which is allowed by TRIPS Agreement."

[265] *See* ["CBD"] *supra* note 244, Art 22.

would prevail because TRIPS is the latter Agreement and the more detailed one for intellectual property protection.

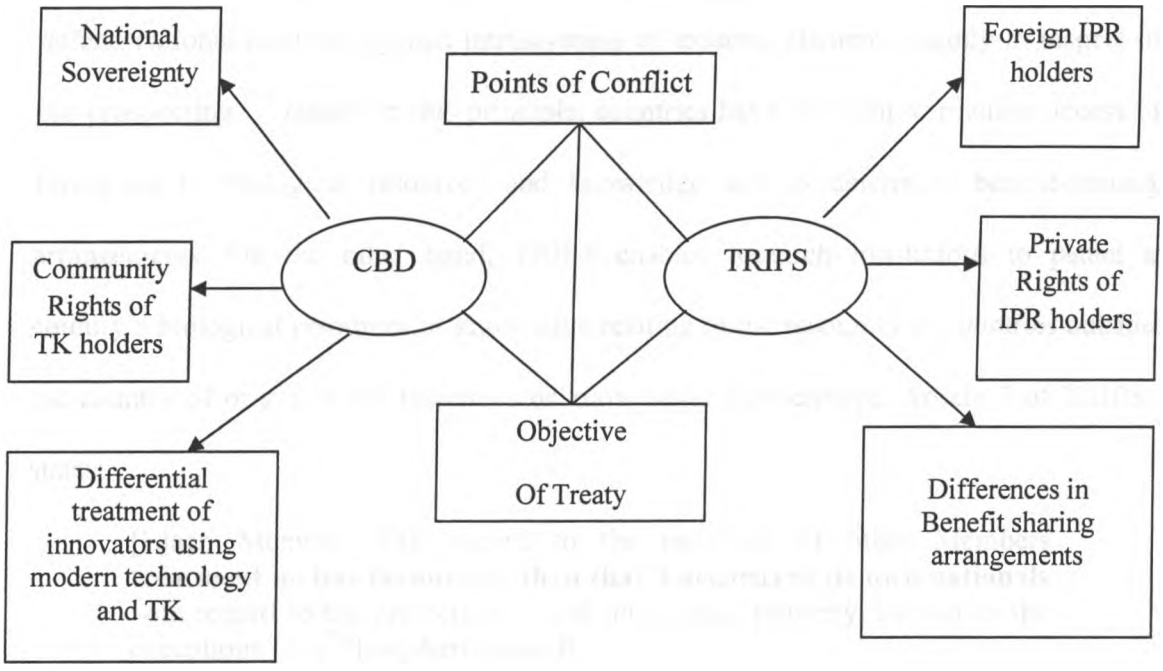

Figure 6: The conflicting relationship between CBD and TRIPS

Figure 6 illustrates the conflicting points between the TRIPS and the CBD. The conflicting points are discussed in detail in the following sections.

CBD was the first international treaty to assert the principle that countries have "the sovereign right to exploit their own resources pursuant to their own environmental policies."[266] This assertion is provided in Article 3 of the Convention. Furthermore, Article 15.1 states:

[266] *See*, G. K. Rosendal, "Regulating the Use of Genetic Resources – Between International Authorities" (2006) 16, Eur. Env. 265 at 267, online <www.interscience.wiley.com> (last accessed on June 12, 2011); The CBD negotiations originally focused on conservation alone. Soon, however, the negotiators included the contested issue of national sovereignty, access and property rights to genetic resources.

> [R]ecognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.[267]

The principle of national sovereignty over genetic resources was provided to defend national interests against intrusiveness of external elements mainly in respect of bio-prospecting.[268] Based on this principle, countries have the right to regulate access of foreigners to biological resources and knowledge and to determine benefit-sharing arrangements. On the other hand, TRIPS enables research institutions to patent a country's biological resources or knowledge relating to the resources in countries outside the country of origin of the resources or knowledge. Furthermore, Article 3 of TRIPS, states:

> [E]ach Member shall accord to the nationals of other Members **treatment no less favourable than that it accords to its own nationals** with regard to the protection [...] of intellectual property, subject to the exceptions [...][269][*emphasis added*]

The Article contains the national-treatment principle, which makes it mandatory for foreigners to have the same rights as citizens to apply for or obtain patents and other intellectual property rights.[270] According to TRIPS, a WTO member must allow foreigners to apply to patent in its country certain categories of living organisms (micro-

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[267] *See* ["CBD"] *supra* note 244, Art 15.1.

[268] *See*, S. A Laird and K. ten Kate, "Biodiversity Prospecting :The Commercial Use of Genetic Resources and Best Practice in Benefit Sharing" in *Biodiversity and Traditional Knowledge : Equitible Partnerships in Practice* (London: Earthscan Publications Ltd, 2002b) online: http://books.google.ca/books?id=l7DLShPm-X0C&pg=PA310&lpg=PA310&dq=Biodiversity+Prospecting:+The+Commercial+laird&source=bl&ots=tFulS7LbRB&sig=U4YM0CTrC7sWJjcZ9CVEJnbdug8&hl=en&ei=JN-jTb3ZB8yJ0QG_y7mDCQ&sa=X&oi=book_result&ct=result&resnum=1&ved=0CBsQ6AEwAA#v=onepage&q=Biodiversity%20Prospecting%3A%20The%20Commercial%20laird&f=false (last accessed on June 12, 2011) wherein Bioprospecting refers to "exploration of biodiversity for commercially valuable biological and genetic resources."

[269] *See*, TRIPS, Art 3.

[270] *Supra* note 221.

organisms) including those from developing countries and even those originating in the Member State. TRIPS facilitate the conditions for the appropriation or misappropriation of ownership or rights over living organisms, knowledge and processes on the use of biodiversity. Even if a WTO member believes it should exclude patenting of genes and micro-organisms, it will be unable to do so, because of the TRIPS provision. Thus, the sovereignty of developing countries over their resources, as well as to determine access and benefit sharing arrangements, is compromised, which is undesirable.

4.5.1 Private rights versus community rights

The preamble to TRIPS recognises that "intellectual property rights are private rights."Article 28 states:

> 1. A patent shall confer on its owner the following exclusive rights:
>
> (a) where the subject matter of a patent is a product, to prevent third parties not having the owner's consent from the acts of: making, using, offering for sale, selling, or importing for these purposes that product;
>
> (b) where the subject matter of a patent is a process, to prevent third parties not having the owner's consent from the act of using the process, and from the acts of: using, offering for sale, selling, or importing for these purposes at least the product obtained directly by that process.
>
> 2. Patent owners shall also have the right to assign, or transfer by succession, the patent and to conclude licensing contracts.[271]

Under Article 28 of TRIPS, a patent confers exclusive rights on its owner to prevent third parties from making, using, offering for sale, selling or importing for these purposes the patented product; and to prevent third parties from using the patented process and from using, selling or importing the product obtained from the patented process. Intellectual property right owners are taken to be natural or legal persons such as

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[271] *See, TRIPS*, Art 28.

corporations and research institutions. The rights conferred are therefore to private individuals or private legal entities. Thus, in TRIPS, the award of intellectual property rights over products or processes confers private ownership over the rights to make, sell or use the product or to use the process or sell the products of that process. This makes it an offence for others to do so, except with the owner's permission, which is usually given only on license or payment of royalty. For instance, *plao noi* which is a herbal plant, has been used by a Thai tribe for stomach ache for generations. The medicinal properties of the herb were recorded on palm leaf parchment called 'samutkhoi.' Japanese researchers learned about the medicinal qualities from the antique recorded medical texts on palm leaf parchments and utilised them for the identification of a drug. Subsequently upon extraction and monopolization of a derivative from the plant, a patent on the resultant drug called Kelnac-Plaunotol was obtained. The inventors indicated that they had for many years engaged in studies for finding novel pharmaceuticals by isolating physiologically active ingredients from plants. As a result of the studies, they isolated a diterpenediol compound, (E,Z,E)-7-hydroxymethyl-3,11,15-trimethyl-2,6,10,14-hexadecatetraen-1-ol, from plants belonging to the genus Croton, particularly Plau-noi (Croton oblongifolius Roxb.) growing in Thailand and also succeeded in chemical synthesis of this diterpenediol compound as well as its homologs and derivatives.[272] Robinson in *Confronting Biopiracy* mentions that one botanist of the Forest Herbarium, National Park Wildlife and Plant Conservation Department, led the Japanese team to explore *plao noi* following the information from specimens recorded in the herbarium.

[272] *See*, D. Robinson and J. Kuanpoth, "The Traditional Medicines Predicament: A Case Study of Thailand" (2009) J.W.I.P 375,403; *See* also, Y. Yuthavong, "Future Vision for Science and Technology in Thailand" in S. Lorlowhakarn and S. Teth-uthapak eds. *Science and Technology in Thailand* (Bangkok: National Science and Technology Development Agency, 2003) at 24.

Several trips were taken for obtaining quality extracts, while no benefits were shared with the Thai authorities, tribals or local traditional knowledge holders conserving the plant, with the exception that the botanist was offered employment as company consultant to the Japanese researchers.[273] Dhillon and Amorpan maintain:

> If the company wanted to employ best practice according to the current principles under the Bonn Guidelines, retrospective benefit sharing could include the transfer of technologies and manufacturing to Thailand.[274]

Thus, intellectual property rights often constitute obstacles to the exchange or flow of knowledge, of products of the knowledge, and their use or production. This system of exclusive and private rights clashes with the traditional social and economic system in which local communities make use of and develop biodiversity. Article 8(j) of CBD recognises the contribution and nature of traditional knowledge (TK) and of the indigenous and local communities that own it. The provision states that each contracting party shall:

> [R]espect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices.[275]

Article 15 spells out conditions for access to genetic resources, requiring that access shall be subject to prior informed consent (PIC) of the contracting party providing

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[273] *See* ["Robinson"] *supra* note 2 at 64.

[274] *See*, S. Dhillion and L.A. Ampornpan, "Bioprospecting and Phytomedicines in Thailand: Conservation, Benefit-sharing and Regulations" in H. Svarstad and S. Dhillion eds. *Responding to Bioprospecting : From Biodiversity in the South to Medicines in the North* (Oslo: Spartacus Forlag AS, 2000) at 57, 76; The Bonn Guidelines on access to genetic resources and the fair and equitable sharing of the benefits arising from their utilization was adopted in CBD's Sixth COP. The guidelines were meant to assist Parties, Governments and other stakeholders in developing an overall ABS strategy and in identifying the steps involved in the process of obtaining access to genetic resources and benefit-sharing; *See*, online http://www.cbd.int/abs/bonn/ (last accessed on January 12, 2011).

[275] *See* ["CBD"] *supra* note 244, Art 8(j).

such resources.[276] This means that the communities which are providers of the resources shall be approached for their consent so as to use their resources. The users namely the multinational companies shall ensure that the communities exercise their rights to participate in benefit-sharing arrangements. However the TRIPS Agreement does not recognise the contribution of community knowledge and community rights.[277] Instead, the TRIPS Agreement favours private individuals and institutions, enabling them to acquire "rights", including rights over the products or knowledge whose development was mainly carried out by the indigenous communities.

TRIPS allows patenting of biological resources, thereby facilitating the misappropriation of the knowledge and resources of indigenous and local communities. Thus the activity of bioprospecting takes the form of biopiracy.[278] As Vandana Shiva maintains:

> [T]he US accused the Third World of piracy [However], if the contributions of Third World people are taken into account, the roles are dramatically reversed: the US would owe Third World countries $302 million in agriculture royalties and $5.1 billion for pharmaceuticals.[279]

The unauthorised access and misappropriation of resource is one of the effects of the "corporate" model within TRIPS which conflicts with the principles and provisions of

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[276] *See* ["CBD"] *supra* note 244, Art 15.5.

[277] *See*, "The Relationship between the TRIPS Agreement and the Convention on Biological Diversity and the Protection of Traditional Knowledge" Country Reports, WTO, Doc IP/C/W/356 and Add.1, June 24, 2002 by Brazil, China, Cuba, The Dominican Republic, Ecuador, India, Pakistan, Peru, Thailand, Venezuela, Zambia and Zimbabwe, noting that, "[a]mendments to the TRIPS Agreement to include an obligation that patent applicants are required to disclose the origin of generic resources and associated traditional knowledge and to provide evidence of PIC and fair and equitable benefit-sharing."

[278] *See*, M. Blakeney, "Bioprospecting and Biopiracy" in B. Ong ed. *Intellectual Property and Biological Resources* (Singapore: Marshall-Cavendish, 2004) at 393 for a critique on how the two terms may have been used interchangeably.

[279] *See* also, V. Shiva, *Biopiracy, The Plunder of Nature and Knowledge* (Cambridge: South End Press, 1997) at 56.

the CBD that oblige member countries to recognise local community rights and fair benefit-sharing. One of the main objectives of establishing the CBD is to counter the possibility of misappropriation or biopiracy,[280] while one of the effects of TRIPS has been to support this practice.

4.5.2 Modern technology and traditional knowledge

Traditional knowledge (TK) refers to the knowledge, beliefs, practices, cultural expressions and innovation that belong to indigenous communities worldwide. These indigenous traditional knowledge systems include valuable understanding of plant, crop and tree species, medicines, animal breeds, biological resources and also encompasses useful technologies. Unlike Western science disseminated through widespread publication, traditional knowledge systems often exist in the form of folklore, community laws, common or collective property and inventions, which are disseminated over generations through elders of the community. The knowledge therefore is of a collective nature, not private to one individual or group.[281]

While CBD recognises the nature and crucial role of traditional knowledge and practices in biodiversity conservation and use as discussed in relation to Article 8(j),

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[280] The term "biopiracy" was originally coined by the Canadian NGO Action Group on Erosion, Technology and Concentration ("ETC Group") – formerly known as Rural Advancement Foundation International ("RAFI") – to refer to the uncompensated commercial use of biological resources or associated traditional knowledge from developing countries, as well as the patenting by corporations of claimed inventions base on such resources or knowledge; *See* also, P. R Mooney, "Why We Call it Biopiracy" in H. Svarstad and S. Dhillon eds. *Bioprospecting: From Biodiversity in the South to Medicines in the North* (Oslo: Spartacus Forlag AS,2000) at 37 for the coinage of the term 'biopiracy'; *See*, C Juma, *The Gene Hunters: Biotechnology and the Scramble for Seeds* (Princeton N.J: Princeton University Press,1989) at 169, noting that, "industrialized nations collect and improve Third World resources before selling such resources at higher prices."

[281] *See* for example, the case of hoodia plant discussed in Ch 1 at 1; *See* also, R. A Mashelkar, "Intellectual Property Rights and the Third World" (2002) 7 J.W.I.P 317, wherein the author discusses about the knowledge relating to the therapeutic properties of turmeric held by Indian communities since generations.

TRIPS is constructed in ways that effectively denies this and instead rewards additions to knowledge even if very slight and minor made through modern technology. This different treatment for modern technology and traditional knowledge is also associated with discrimination against local community rights.

According to Gurdial Singh Nijar[282] the "definitional constructs in TRIPS are selectively in favour of the developed economies and marginalised developing economies."[283] The criteria for a patent claim for an invention under Article 27.1 of TRIPS are that it must be new, involve an inventive step and be capable of industrial application. Therefore, according to these requirements there must be an identifiable inventor. This definition almost immediately dismisses the knowledge systems and the innovations of indigenous people and farmers because they innovate communally.

The prior informed consent requirement is thus a measure to prevent misappropriation of resources and knowledge, and to facilitate fair benefit-sharing. In TRIPS, there is no provision that applicants for patents over biological resources have to obtain prior informed consent. There is no recognition in TRIPS of the rights of the country in which the biological resource or knowledge of its use is located. Patent applicants can submit claims on biological resources to patent offices in any country that recognises such patentability and the patent office can approve the claims without going through a process of checking with the authorities of the country or countries of origin. Thus, while the CBD has established the principle and obligation of PIC as a check against misappropriation or biopiracy, TRIPS on the other hand facilitates the possibility

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[282] *See*, G. S. Nijar, *TRIPS and Biodiversity: The Threat and Responses: A Third World View* (Penang Malaysia: Third World Network, 1996) at 41.

[283] *Ibid.*

of such misappropriation by not recognising the need for and thus omitting a mechanism of prior informed consent.

4.5.3 Access and Benefit-Sharing Arrangements

One of the key aspects of CBD is that it recognises the sovereign rights of States over their biodiversity and knowledge, and thus gives the State rights to regulate access, and this in turn enables the State to enforce its rights on arrangements for sharing benefits. Grant of access shall be on mutually agreed terms[284] and shall be subject to prior informed consent.[285] Providers of the resources should fully participate in the scientific research[286] and most importantly, each country shall take legislative, administrative or policy measures with the aim of sharing in a fair and equitable way the results of research and development, and the benefits arising from the commercial and other utilisation of genetic resources with the contracting party providing such resources. Such sharing shall be upon mutually agreed terms.

TRIPS does not have a provision for benefit-sharing with the State or communities in countries of origin. If a person or corporation obtains a patent based on the biological resource or related knowledge in another country, little can be done by the country of origin to enforce its benefit-sharing rights. It is true that a legal challenge can be launched by the state or citizens of the country of origin. However, such legal cases are expensive to take up. Even if a state has the resources to legally challenge a particular patent in another country, it may not have the resources to track down and challenge

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[284] *See* ["CBD"] *supra* note 244, Art 15.4.

[285] *See* ["CBD"] *supra* note 244, Art 15.5.

[286] *See* ["CBD"] *supra* note 244, Art 15.6.

every patent that it believes to embody biopiracy. Moreover, there is no certainty that such challenges will be successful, since the matter has to be referred to the dispute resolution mechanism of the WTO. It is disheartening to note that if the patent laws, the administration of approvals or the Courts of a particular country operate in a context that is favourable to the granting of such patents, there is little that can be done by a country of origin to ensure that biopiracy does not take place or that, if it takes place, it can be resolved.

One prominent example of biopiracy is the patenting of the therapeutic properties of Neem. Local communities in India have regarded Neem as a free pharmacy or the cure for almost all ailments for over 2000 years. Reportedly, in total, 23 parts of the Neem tree are used in traditional medicinal remedies and practices.[287] These include "medicine for wounds, protection of teeth and gums, the accumulation of anti-bodies, detoxification, a cure for smallpox, hysteria, leprosy, AIDS, malaria and snake bites as well as numerous disinfectant and cosmetic uses."[288] Between 1994 and 1999 around 70 patents were granted to Western universities, drug and cosmetic companies, and genetic researchers regarding different properties and genes of the tree. In 1994 the European Patent Office (EPO) granted W.R. Grace EP 0436257 for a "method for controlling fungi on plants by the aid of hydrophobic extracted Neem oil".[289] A group of international Non-Governmental Organisations (NGO) and representatives of Indian farmers filed legal opposition submitting evidence that the fungicidal effect of Neem seed extracts had been

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[287] *See*, A. Purvis, "Nature's Pharmacy" The Guardian (30 May 2002) online: http://www.guardian.co.uk/education/2002/may/30/medicalscience.aids?INTCMP=SRCH, (last accessed on September 15, 2011).

[288] *Ibid.*

[289] *Id.*

known and used for centuries thereby negating the novelty requirement for patentability. The debate reached a conclusion in 1999 when the EPO, revoking the patent, found that according to the evidence "all features of the present claim have been disclosed to the public prior to the patent application ... and [the patent] was considered not to involve an inventive step."[290] It is important to note that the patent was only subsequently revoked and that W.R. Grace was able to exploit its monopoly until 2000. Equally important is the fact that the patent was granted in Europe and was not subject to the lax perception of prior art applicable in the US.

Similarly, the bark of *Banisteriopsis caapi* has traditionally been used by indigenous shamans to diagnose and treat illnesses. A specimen was granted US Plant Patent 5,751 in 1986. The Coordinating Body of Indigenous Organizations of the Amazon Basin learnt of the patent in 1994 and a re-examination was requested on behalf of them by the Centre for International Environmental Law on grounds of prior art and also by suggesting that such a patent would be contrary to the public morality aspects of the US Patent Act due to the sacred nature of the plant throughout the Amazon Region. Despite such persuasive arguments, the USPTO ordered that the patent should stand.[291] This example represents an "as is" form of biopiracy where the raw material has not undergone any further improvement and is therefore even more lamentable.

Protection of the environment is at the heart of the rationale and provisions of the CBD. The objectives of the Convention as provided in Article 1 include:

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[290] *See,* Section 102 of the *US Patent Act.*

[291] *See,* J. Barton *et al., Integrating Intellectual Property Rights and Development Policy* (London: Commission on Intellectual Property Rights, 2002) at 24.

> [T]he conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.[292]

Countries are obliged to develop strategies and plans to conserve and sustainably use biodiversity, and integrate conservation and sustainable use of biodiversity in sectorial and cross sectorial plans and policies;[293] to carry out *in situ* and *ex situ* conservation;[294] to minimise adverse impacts on biodiversity whilst also carrying out remedial action in degraded areas;[295]and to conduct environmental impact assessments on and minimise adverse impacts of projects.[296] TRIPS does not have environmental protection as part of its objectives. Unlike the CBD, the promotion of environmental goals is not part of its rationale. It does however have provisions that enable members to exclude patents on environmental grounds. Article 27.2 states:

> [M]embers may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre public* or morality.[297]

The differences between the two agreements demonstrate the conflict between "western big business [...] couched in international trade and the pre-existing economic and cultural values of developing countries."[298] The two agreements emphasize the

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[292] *See* ["CBD"] *supra* note 244, Art 1.

[293] *See* ["CBD"] *supra* note 244, Art 6.

[294] *See* ["CBD"] *supra* note 244, Arts. 8 and 9.

[295] *See* ["CBD"] *supra* note 244, Art 10.

[296] *See* ["CBD"] *supra* note 244, Art 14; *See* also, ["Khor"] at 55,"Article 19 requires parties to consider the need for an international biosafety protocol (which has now been established) to deal with the safety aspects of biotechnology and international transfer of genetically-modified organisms."

[297] *See*, TRIPS Art 27.2.

[298] *See*, D. M. Strauss, "The Application of TRIPS to GMOs: Intellectual Property Rights and Biotechnology" (2009) 45 Stan J Intl Law, 287.

differences in the objectives and values rather than the implicit functions of the agreements. The implicit value of nature is embraced by the CBD which is considered as the cornerstone for international environmental interests.[299]

Biological diversity is considered to be about more than plants, animals and micro-organisms and their ecosystems. It is about people and their need for food security, medicines, fresh air and water, shelter and a clean and healthy environment in which to live. TRIPS takes a proprietary approach to the biotechnology industry, in that genetic material and life forms represent commodities, whose ownership becomes exclusive and remunerative. Therefore, TRIPS allows for intellectual property protection that can be implemented in a manner that undermines the CBD's objectives.[300] TRIPS neither require "sharing the benefits of biotech products with the countries that supply the genetic resources nor gives recognition for the traditional knowledge of original communities as a form to be patented."[301] Additionally TRIPS does not require the disclosure of the origin of the resources for applicants to exercise their rights.[302]

4.6 Can CBD and TRIPS be reconciled?

The US in its country report before the TRIPS Council meeting in March 2006,[303] argued that the CBD's objectives on access to genetic resources, and on benefit sharing could best be achieved through national legislation and contractual arrangements based on the legislation, which could include commitments on disclosing of any commercial

[299] *Ibid* at 305.

[300] *Id* at 309.

[301] *Id.*

[302] *Id.*

[303] *See*, United States, WTO, Doc IP/C/W/469, March 13, 2006 WTO, Doc IP/C/W/254, WTO, Doc IP/C/M/35 ["US Country Report"].

application of genetic resources or traditional knowledge.[304] According to the US, there is no conflict between the TRIPS Agreement and the CBD. The two agreements can be implemented in a mutually supportive manner.[305] The absence of provisions in the TRIPS Agreement to protect genetic resources from misappropriation and theft does not indicate conflicts between its implementation and the CBD. The lack of clearly defined national systems directly regulating the use of genetic resources, particularly in the context of access and benefit-sharing (ABS) systems creates an "erroneous" treatment of the relevant resources, not the "lack of safeguards" in the TRIPS context, as accused by India, Brasil and others.[306] The US proposed, "national contract-based systems to meet the demands of achieving appropriate access and equitable benefit sharing."[307] Therefore, the developed world views TRIPS and CBD to be in harmony rather than conflict even when there are obvious instances of conflicting implementations.

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[304] *Ibid* at 83, "[t]he position of the USA was that a contract-based system provided many advantages for protecting access to and use of genetic resources or traditional knowledge of indigenous populations, many of which would not be available in a patent system. For example, contracts provided a mechanism to properly obtain genetic resources or traditional knowledge from the provider for research and permit benefit sharing arrangements between the provider of the resource and the user of that resource. Contracts could also include research reporting requirements, rules on how to transfer, store or use the genetic resources or traditional knowledge, and set out clear ways to resolve any future disputes that may arise between the provider and user. By contrast, the patent system could not ensure authorized access to genetic resources and equitable sharing of their benefits. Contracts could be precisely tailored to accomplish these goals."

[305] *See* ["US Country Report"] *supra* note 303, Document IP/C/W/469; *see* also, ["Gervais"] *supra* note 221 at 83.

[306] *See*, Technical Observations on the US Submission IP/C/W/449 by Bolivia, Brazil, Columbia, Cuba, India and Pakistan, "The Relationship between the TRIPS Agreement and the Convention on Biological Diversity (CBD) and the Protection of Traditional Knowledge," WTO, Doc IP/C/W/459, (2005) online : http://commerce.nic.in/ip-c-w-459.pdf (last accessed on July 01, 2011); *see* also, ["Gervais"] *supra* note 221 at 83.

[307] *Ibid* ["Gervais"] at 83; *See* also, Access and Benefit-Sharing, Draft decision submitted by the Co-Chairs, UNEP/CBD/COP/9/ICG-ABS/CRP.1/Rev.1, May 28, 2008, UNEP, 2008, "the Ninth Session of the Conference of the Parties to the Convention on Biological Diversity," 101 at 120, wherein it was decided that an international regime on equitable access and benefit sharing (ABS) in the context of the CBD would be established. This was a parallel development in the context of CBD.

4.7 Summary

This chapter identifies the tension between TRIPS under the auspices of the World Trade Organisation and the United Nation's Convention on Biological Diversity, 1992 with technology transfer as its focal point. The negotiating history of the two Treaties reveals that technology transfer has been a bargaining tool for the developed countries. Technology transfer is an issue that divides the world into two realms, namely affordability and availability. The MNCs driving the discussions of the TRIPS Agreement have required stronger intellectual property rights for the purposes of transferring their technologies. By the mid-1990s, a minimum global standard for intellectual property rights had been enshrined in the WTO Charter through the incorporation of the TRIPS Agreement. The shift in international policy making from its traditional postwar focus on the lowering of tariff and nontariff trade barriers to the embrace of strong intellectual property rights has been controversial. Stronger intellectual property rights in developing countries may work against national economic interests, transferring rents to multinational corporate patent holders headquartered in the world's most advanced countries, especially the US. Intellectual property rights advocates counter that strengthening intellectual property rights will induce more innovation in the global economy, thereby fostering more rapid economic growth. Throughout the 1980s and 1990s, a number of countries undertook substantial reforms of their patent systems. The interpretation that intellectual property rights' reform results in an increase in technology transfer among US multinationals is strengthened by the fact that R&D spending by affiliates – usually viewed as a complement to technology imports from the parent – increases after intellectual property rights reform. The CBD on the other hand conflicts on significant points with that of TRIPS. Issues of access and transfer of technology ought to

adhere to a bilateral arrangement between the provider of technology and the recipient of technology as per CBD. The principles enshrined within the CBD are prior informed consent (PIC) and mutually agreed terms (MAT). The CBD provision on technology transfer conflicts with the non-discrimination provision of the TRIPS Agreement.

The examination of the provisions pertaining to technology transfer in the TRIPS Agreement indicates that technology transfer was used as a major bargaining tool for encouraging the developing and least developed countries to approve the TRIPS Agreement. The enterprises which were technology holders and developers could abuse their monopoly rights in the patented technology and charge increased cost to the consumers in the developing countries. Therefore the issue of facilitating technology transfer and access to technology remain as mere words in the text.

The basic concerns of the developing countries in terms of survival, preservation of resources for future use, accessibility to food and health can be found in the provisions of multilateral treaties such as the CBD. Both the treaties contain provisions pertaining to access and transfer of technology and benefit sharing in favour of LDCs. However, when it comes to implementation, transferring (bio-based) technology is found to be in direct opposition to the TRIPS Agreement. Provisions pertaining to technology transfer in CBD are found to be potentially conflicting with the non-discrimination provision in the TRIPS Agreement. This study finds the TRIPS Agreement and CBD to have conflicting policies. Articles 15.7, 16.2 and 16.3, 19.1 and 19.2 of CBD provide for priority access, preferential terms and requirements of joint research projects respectively which are not contained in the TRIPS Agreement. The proponents of the South, such as Brazil, India and Malaysia believe that TRIPS and CBD are incompatible and the TRIPS Agreement

encourages biopiracy by means of non-disclosure of the source of the genetic resources. On the other hand, the proponents of the North, the US and EU expressly deny such claims. The international viewpoint on technology transfer is both complex and controversial. The perspective on technology transfer at the international realm depends on who is the holder of the technology and who is the user of the technology. The MNCs have introduced a "corporate" model within the "developmental" model in the international policy making environment which gives way to barriers in conducting research for innovation. It is submitted that it is essential to preserve the developmental and participatory approach for safeguarding the interests of the resource providers who are also the primary consumers of the technology. In the following chapter, an alternative approach in international policy-making that may achieve the middle-ground of satisfying the demands for profit as well as sustainable development is identified.

Chapter 5

5. Conclusion

> [T]he most important and urgent problems of the technology of today are no longer the satisfactions of the primary needs or of archetypal wishes, but the reparation of the evils and damages by the technology of yesterday. [308]
>
> - Dennis Gabor

Gabor emphasizes the new role of modern day technology. The "corporate" model of increased interaction with multinational companies for better access to resource, products and technology is prevalent in the domestic as well as the international level of policy making. This "corporate" model has transformed the age-old enterprise of "knowledge sharing" which led to scientific progress and technological development from a "developmental" model to an exploitative one. This study examines the enterprise of "knowledge sharing" through the perspectives of technology transfer.

The theoretical as well as the domestic and international perspectives of technology transfer were analysed to identify a shift in the rationale for public interest and public policy. It is found that universities and research institutes advocate "knowledge sharing" in their mission statements and are generally committed to generating, disseminating and preserving knowledge and to working with others in disseminating this knowledge. Academe's principle regarding technology transfer is also grounded on the perspective that it propels new research collaborations, exchanges of materials, information and personnel with industry, which adds new dimensions to university research programs and, at the same time, presents unique research opportunities for

[308] D. Gabor, *Innovations: Scientific, Technological and Social* (Oxford: Oxford University Press, 1970) at 26.

faculty and students. The different models of scientific research and technology transfer that were analyzed in Chapter 3 of this study further directs one to the conclusion that academic universities principally share similar aims of promoting integrity in scientific research and fostering an open method for achieving accuracy in scientific research and innovation, which is significantly beneficial to mankind. However, while academia is motivated by the quest for knowledge and to accomplish its duty to human kind, private industry, in contrast, has a responsibility to satisfy its investors and shareholders whose motivation is financial gain. Partnership between the university and industry has resulted in the attrition of the values of progress by means of "knowledge sharing". Industry contributes to university research because of the potential of reaping exclusive benefits through licensing and commercialization agreements. Both university and industry play unique roles in society and their interaction may lead to compromising the virtue of communalism which leads to better research and innovation.

The role reversal of a non-profit organisation into an entrepreneur has led to the patenting of basic science and research tools considered as building blocks for further innovation. Public research organisations have drifted into a capitalistic mode, while the traditional norms of optimal scientific production advocated by the likes of Merton call for the need for a participatory approach. "Knowledge sharing" as an ethos has somewhere blurred into the sidelines at the domestic realm.

Analysis of various technology transfer policies implemented by the US and Canadian governments as well as the provisions of TRIPS and CBD in support of technology transfer provides answers to this study's research questions including:

- Whether laws and policies pertaining to technology transfer at the domestic and international level support a "developmental" perspective towards scientific research and technology transfer?
- What are the implications of excessive commercialisation of science and technology on the traditional enterprise of "knowledge sharing"?
- Does the "corporate" model transform the traditional enterprise of "knowledge sharing" and technology transfer into an exploitative one both at the domestic and international level?

While the government supported policies on R&D initially generated successful research results; more patents, non-disclosure clauses and material transfer agreements into academe as an outcome of commercialization have demonstrated interference with access to research results and materials. Increased commercialization has not directed better conditions for research and innovation in areas for which huge public funds are invested. In order to benefit from royalty payments, universities have engaged in practices that can scarcely be regarded as compatible with the public interest. These practices include exclusive licensing and claiming ownership over fundamental research tools.

As a response to this study's main question and from the examination of various instances of commercialization of technologies and resources (especially bio-based), there are conflicting provisions at the international level which are supportive of the "corporate" model of scientific research and consequentially hinder access to technology for further innovation. As discussed in Chapter 4, the TRIPS Agreement brought the perception that technology transfer was the way by which developing countries could acquire foreign technology and scientific knowledge from developed countries rather than

developing them on their own. An examination of the negotiating history of TRIPS shows that it was drawn up with the encouragement and active support of large corporations to promote their technological dominance and gain additional margins of profit through obtaining private monopolies. Being a commercial treaty, TRIPS incorporates commercial objectives to largely benefit private firms. Furthermore, TRIPS and the enactment of patent laws relating to biological materials in some countries have facilitated the misappropriation of knowledge and resources of indigenous and local communities, resulting in an increase in the number of biopiracy cases. TRIPS, is established in ways that effectively denies traditional knowledge and instead rewards additions to knowledge, even if very slight and minor additions are made through modern technology. This different treatment for modern technology and traditional knowledge is also associated with discrimination against local community rights.

On the other hand, the CBD, which recognizes the need to regulate the behaviour and effects of private corporations and researchers was established during the same period as TRIPS, but has not been ratified by developed countries such as the US. The CBD is dedicated to promoting sustainable development and addressing problems associated with the exchange and use of plant genetic resources. CBD allows developing countries which are biodiversity rich to regulate access to their genetic resources and to share in the benefits arising from their use.

There are conflicting implementations, policies, and points of view on commercialising and transferring scientific research and technology at the domestic and international level. The perspective on technology transfer ultimately depends on who is the holder of the technology and who is the user of the technology. The developmental

and participatory approach, safeguards the interests of the resource providers, academic and scientist researchers, entrepreneurs as well as consumers of the technology.

5.1 Recommendations and Alternative Approaches

Taking a pragmatic view that while there are difficulties in reconciling the incompatibilities between the "corporate" and "developmental" approaches to technology transfer, the best way to achieve reconciliation is through amendments and additions to the existing systems of intellectual property rights, their protection and policies.

In order, to save the interest of the academic as well as the scientist researcher, it is submitted that research tools should be given broad exemption compared to other patentable inventions. An amendment to clarify the experimental use provision in the Canadian Patent Act or a clear judicial pronouncement is desired.

Adoption of an open developmental model for accessing resources should find a place both in letter as well as in the spirit of laws and policies. One recommendation that can be made is that exclusive or narrow licensing by a university should require an explicit rationale. Open licensing may be resisted by university administrators and researchers on the grounds that it would diminish their ability to maximise financial returns from their portfolio. The principal support for university patenting with freedom to license arises from their perception that it increases their ability to generate revenue. The recent 2008 Statscan data on the "Intellectual Property Commercialisation in Higher Education Sector"[309] as well as studies by Mowery *et al.*,[310] reveal that patenting research results as such does not lead to increase in revenue or profit by universities. Only a small

[309] *See* ["Statscan Survey-2008"] *supra* note 126.

[310] *See* ["Mowery *et al.*"] *supra* note 91; *See* also ["Nelson *et al.*"] *supra* note 86.

fraction of universities bring in more money from their patenting and licensing operations than they spend on them.

The traditional approach inherent in communalism seeks to align the interests of scientists and organisations with the overarching institutional goals of scientific progress, defined as "the extension of knowledge certified as true."[311] Scientific findings are a product of collaboration, "a common heritage that should be dedicated to the scientific community."[312] Open source licensing seeks to maximize the amount of improved technology available by ensuring that advances remain openly accessible.[313] Kenneth Neil Cukier notes:

> [T]here is currently no legal equivalent that can act alongside the patent system for protecting inventions to ensure that they are opened up – indeed, it is tricky to see how it might be put into practice. An offshoot of Creative Commons called the Science Commons has formed to try to devise just such a mechanism.[314]

Moreover, "[s]olidarity is [also] a core value of modern healthcare (and the welfare state) and has been described as essential for redressing the growing global healthcare deficit."[315] A general policy of open licensing of university research results can set the stage for downstream applied R&D. A novel example of preserving the communal approach to research is found in the Stanford University policy regarding material transfer

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[311] *See*, J. E Hope, *Open Source Biotechnology* (PhD thesis, Australian National University, 2004), *cited in* B. M. Knoppers and Y. Joly, "Our Social Genome?" (2007) 25:7 Trends in Biotechnology 284.

[312] *See*, B. M. Knoppers and Y. Joly, "Our Social Genome?" (2007) 25:7 Trends in Biotechnology 284.

[313] *See* also, R. Feldman, "The Open Source Biotechnology Movement: Is It Patent Misuse?" (2004) 6 Minn.J. L Sci & Tech. 117 at 120.

[314] *See*, K. N. Cukier, "Navigating the Future(s) of Biotech Intellectual Property" (2006) 24 Nature Biotechnology 249 at 251.

[315] S. H. E. Harmon, "From Engagement to Re-Engagement: The Expression of Moral Values in European Patent Proceedings, Past and Future" (2006) 5 Eur.L.Rev. 642.

agreements (MTAs). Stanford University has an extremely simple procedure for MTAs, i.e., if the recipient is in academia or a not-for-profit institution, no MTA is required. If the recipient is in industry, three options are there for the donor: where the donor is certain that the material will be used for research purposes only, then again no MTA is required, and where the donor is uncertain he may either insist on an MTA where the recipient confirms use will be only for research purposes, or he may refer the matter to the TTO for licensing.[316] The Stanford model MTA gives way to a form of standardization which removes a barrier to academic cooperation and is one step towards reversing the current erosion of the key academic values of collaboration and openness.[317]

An open source MTA may serve the ends of preserving the ethos of science as well as facilitate access to research materials.[318] A similar principle is found in the international treaty framework as well.

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), which came into force on June 29, 2004[319]adopts an open approach to facilitate the international transfer of genetic resources. The Treaty is administered by the

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[316] *See* ["Sigrid Sterckx"] *supra* note 181 at 59; For more information, *see* also, J. Sandelin, "The Stanford University Knowledge Transfer Model" online 'http://www.auril.org.uk/media/AURIL%20Conference%202007/Sandelin%20Jon.pdf. (last accessed on June 28, 2011).

[317] *Ibid.*

[318] *See* also, T. Margoni, "The Roles of Material Transfer Agreements in Genetic Databases and Biobanks" in U. Izzo, G. Pascuzzi and M. Macilotti eds. *Comparative Issues in the Governance of Research Biobanks. Property, Privacy, Intellectual Property and the Role of Technology* (SpringerLink, 2011) *forthcoming* on file with author, wherein a metadata driven approach is proposed as a methodology that can be implemented by many different players and projects in different ways. Recall[ing] that access to knowledge and participation to scientific and technological growth are a public policy goal, hardly can they be achieved through a private ordering tool.

[319] *See*, *International Treaty on Plant Genetic Resources for Food and Agriculture* (November 3, 2001) online: ftp: //ftp.fao.org/ag/cgrfa/it/ITPGRe.pdf (last accessed on June 12, 2011) ["ITPGRFA"].

United Nations Food and Agricultural Organization's Commission on Genetic Resources for Food and Agriculture.[320] The ITPGRFA is relevant to agricultural plant-based biopiracy as it seeks to globally administer the exchange of crop germplasm.

The objective of the Treaty is stated in Article 1:

> [T]he objectives of this Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, **in harmony with the Convention on Biological Diversity,** for sustainable agriculture and food security.[321] [*emphasis added*]

The principal aim of ITPGRFA is to utilize the multilateral system for facilitating the exchange of seeds and other plant materials for research, breeding and crop development purposes through which member states will be granted facilitated access.[322] Article 12.1 of the ITPGRFA provides for facilitated access to plant genetic resources under the multilateral system created by the Treaty, and is restricted only to the specific list of genetic resources for food and agricultural purposes contained in Annex 1 of the Treaty. **The Treaty provides that the recipients shall not claim any intellectual property rights that may limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic components in the form received from the**

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[320] CBD did not provide for access or the sharing of benefits related to certain categories of genetic resources. In particular, it did not cover *ex situ* material collected before it sentry into force, including gene bank collections of the International Agricultural Research Centres of the Consultative Group on International Agricultural Research ("CGIAR") as well as many national collections. However the Nairobi Conference, where the CBD was adopted, recognised the need to specifically address these categories of PGR, especially those within the Global System for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture established by the FAO; *See*, "Nairobi Final Act of the Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity" (May 22, 1992), online: <http://www.cbd.int/doc/handbook/cbd-hb-09-n.pdf> (last accessed on June 12, 2011).

[321] *See* ["ITPGRFA"] *supra* note 319, Art 1.

[322] *See* for instance, M. Blackeney "Agricultural Research: Intellectual Property and the CGIAR System" in P. Drahos and R. Mayne eds. *Global Intellectual Property Rights: Knowledge, Access and Development* (Basingstoke: Palgrave Macmillan, 2002) at 108.

multilateral system.[323] The multilateral system also covers *ex situ* collections in biobanks of the International Agricultural Research Centres (IARCs) of the Consultative Group on International Agricultural Research (CGIAR). In essence, the treaty attempts to formalize the transfer of agricultural plant genetic resources, thus potentially inhibiting biopiracy incidents and ensuring more transparent administration of the IARC biobanks.

Parties that ratify the International Treaty effectively open up their agricultural plant genetic resources to access via a Standard Material Transfer Agreement (SMTA) in accordance with Article 12.4 of the Treaty. The SMTA adopted under the treaty establishes a contract between the provider and recipient of plant genetic resource products for food and agriculture incorporating materials or any of its genetic parts or components that are ready for commercialization.[324] This excludes products used for food, feed and processing. Furthermore, Article 5 of the SMTA requires that the provider should submit all available data and descriptive information about the materials. Access to these materials protected by intellectual property rights must be consistent with international and national laws. During the period of plant genetic resource development including material being developed by farmers, access is at the discretion of its developer. Article 6 of the SMTA provides that the recipient must use the materials only for the purposes of research, breeding and training for food and agriculture, and must not claim intellectual property

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[323] *Supra* note 319 at 230, "[T]he multilateral system is a communal seed treasury composed of 35 food and 29 feed crops held both by states and Consultative Group on International Agricultural Research (CGIAR) gene-banks. In exchange for access to this common seed pool, private parties that create commercial products which incorporate PGRs received from the multilateral system must pay a percentage of profits into a fund to be administered by the treaty`s governing body. The fund will be used to promote conservation and sustainable use of PGRs."

[324] *See* ["ITPGRFA"] *supra* note 319 Art 2, Standard MTA "...understood to mean: materials of plant origin, including reproductive and vegetative propagating materials, containing functional units of heredity."

rights that may limit facilitated access to the materials or their components. This Article is an attempt to limit biopiracy involving the exclusion of plant usage by others. In cases where a recipient commercializes a product, a payment of 1.1 % of the sales of the product, or products less 30%, must be paid to the Trust Account of the governing body.[325] That is to say that in practice, the payment must be 1.1 % of 70 % of gross sales of the product. In other words, 0.77 % of total sales.

Article 13 of ITPGRFA provides that, the multilateral system co-ordinates benefit sharing through a range of mechanisms, including exchange of information, access to and transfer of technology, capacity building and the sharing of monetary and other benefits arising from commercialization. The multilateral system is administered by governing body, composed of all the contracting parties,[326]and has a rolling Global Plan of Action.[327] Article 13 of ITPGRFA lists possible benefits and sharing mechanisms declaring that "facilitated access" to PGR for food and agriculture is itself a "major benefit."[328] A major problem in negotiating arrangements for benefit-sharing in regard to plant germplasm used for food and agriculture is that, while it is unethical to disregard the contributions made by many farmers over many generations, the economics of tracking these contributions and adding value to it is not practicable. A SMTA under the ITPGRFA may incorporate open source-style terms that would make access to the evolving technology

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[325] *See* ["ITPGRFA"] *supra* note 319, Annex 2, SMTA.

[326] *See* ["ITPGRFA"] *supra* note 319, Art 19; *See* also, *supra* note at 241, Art 14 also explains about a rolling Global Plan of Action. Furthermore Art 17 of *ITPGRFA* calls upon Parties to collaborate with each other to develop a Global Information System on plant genetic resources for food and agriculture in order to complement those already existing in the IARCs.

[327] *See* ["ITPGRFA"] *supra* note 319, Art 14.

[328] *See* ["ITPGRFA"] *supra* note 319, Art 13.2(d).

the usual reward for contributions rather than direct remuneration through royalties or similar payments.

Article 1 of ITPGRFA declares that the Treaty is in harmony with the CBD in terms of access to resources. However their approaches in terms of sharing benefits between the provider and recipients largely differ. While the CBD deals with biological diversity and sets the framework for conservation and sustainable use of genetic resources, including access and benefit-sharing; its objectives are basically related to the environment and trade in genetic resources. The ITPGRFA deals with issues raised by the conservation and sustainable use of plant genetic resources and the objectives are more focused on food and agriculture. The ITPGRFA is essentially based on the premise that the private sector and market forces approaches do not really function well for agriculture and since agriculture has always been based on easy access and free exchange, a more "communal access" approach in regard to the relevant genetic resources is needed.[329] The treaty provides conservation and continued flow across national boundaries of the plant genetic resources most important to sustaining food security. Article 16 of the CBD[330] and Article 13.2 of the ITPGRFA concern access to and transfer of technology. Article 13.2 of ITPGRFA provides:

> [T]he Contracting Parties agree that benefits arising from the use, including commercial, of plant genetic resources for food and agriculture under the multilateral system shall be shared fairly and equitably through the following mechanisms: the exchange of information, access to and transfer of technology, capacity building and sharing of the benefits arising from commercialization taking into account the priority activity

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[329] *Ibid.*

[330] *See* ["CBD"] *supra* note 244, Art 16.

> areas in the rolling Global Plan of Action, under the Guidance of the Governing Body.[331]

Both these provisions, namely Article 16 of CBD and Article 13.2 of ITPGRFA explicitly refer to developing countries in the area of technology transfers, emphasizing their need for concessional access. The open source style MTA of the ITPGRFA may assist in allaying the concerns of the developing economies and facilitate access to technology essential for the purposes of subsistence and survival. Thus the emerging exploitative perspective of technology transfer may be reversed to it traditional enterprise of "knowledge sharing."

Figure 7 is a flowchart of the arguments and submissions canvassed in the study. The thesis statement along with two main supporting arguments are presented. This thesis recommends that an open access approach to scientific research and innovation be adopted to achieve the policy objectives as well as the goal of "knowledge sharing."

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[331] *See* also ["ITPGRFA"] *supra* note 319, Art 13 - Benefit-sharing in the Multilateral System -
13.1 The Contracting Parties recognize that facilitated access to plant genetic resources for food and agriculture which are included in the Multilateral System constitutes itself a major benefit of the Multilateral System and agree that benefits accruing there from shall be shared fairly and equitably in accordance with the provisions of this Article.

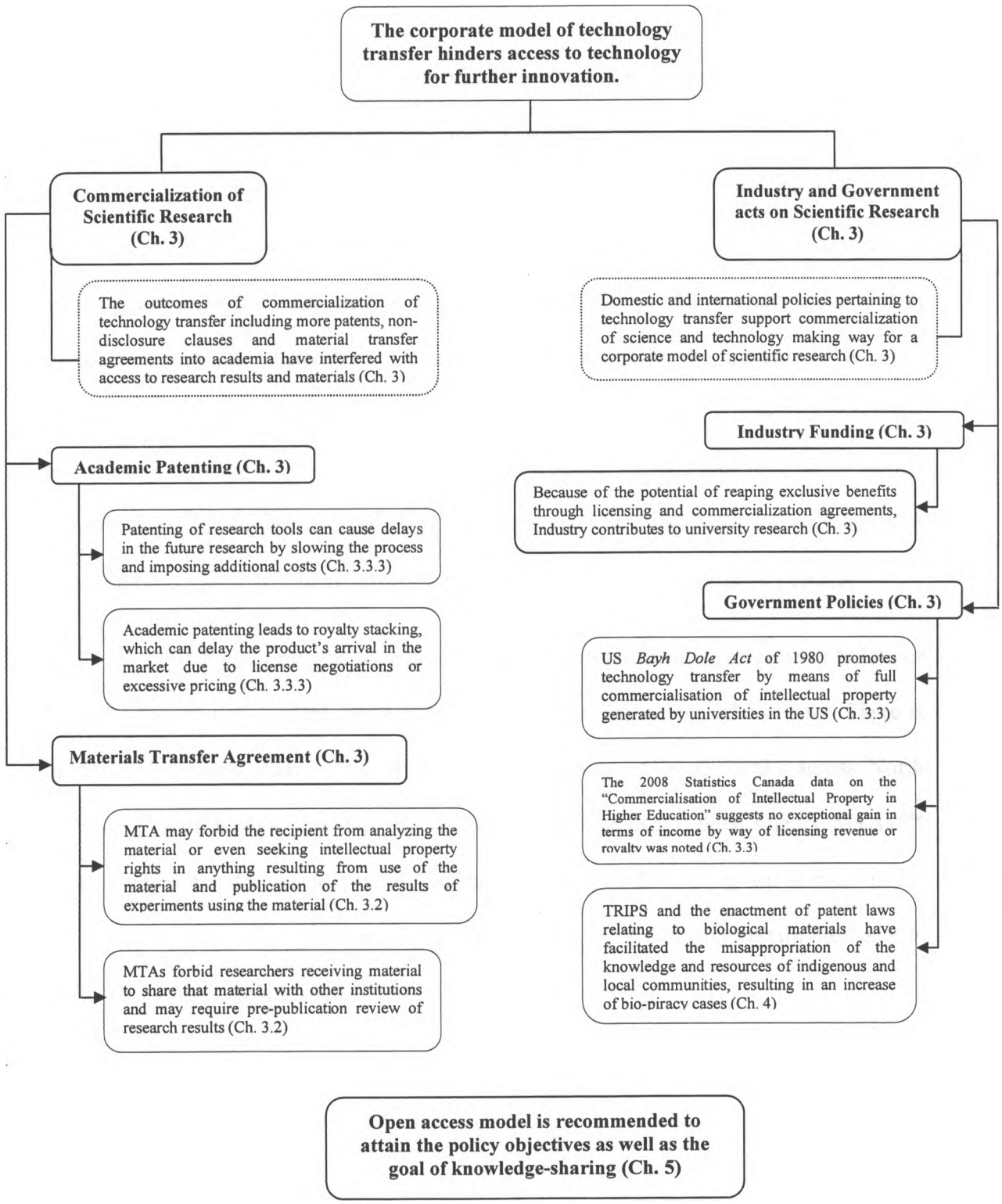

Figure 7: Flowchart of Arguments

5.2 Future Research

This thesis identifies the presence of a "corporate" model making room for exploitation within the "developmental" model in connection with technology transfer at two levels. One at the public-private partnership supported by domestic policies of developed countries and the other at the international policy making angle. For future work, a compilation of case studies of the commercialisation of university inventions in Canada, examining whether an exclusive license facilitates the transfer of a given technology or whether technology transfer proceeded just as fast and widely when the results were in the open literature, should be undertaken. The findings may be forwarded to the concerned Ministries as an effort to demonstrate the importance and co-relation of non-proprietary research and innovation and the consequent need for policy change.

A similar study may be undertaken to assess the use of the open science MTAs or the SMTA formulated under the ITPGRFA by government sponsored biobanks. There is only one informed study, which is based on a survey of 31 biobanks across North America, Japan, Europe and Asia, concluding the lack of use of open science MTAs.[332] More studies are desired to provide definitive examples discussing the impact of the Treaty on the national regulation of plant genetic resources and to ascertain the benefits and costs associated with such adoption.

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[332] M. Perry., "Accessing Accessions: Access to Biobanks" in U. Izzo, G. Pascuzzi and M. Macilotti eds. *Comparative Issues in the Governance of Research Biobanks. Property, Privacy, Intellectual Property and the Role of Technology* (SpringerLink, 2011) *forthcoming* on file with author.

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Email correspondence dated July 04, 2011 with Terry Donaghue, Director, Technology Transfer and Industry Liaison, Mount Sinai Hospital Foundation, Ontario, Canada.

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Appendix A

A. Ontario Research Commercialization Program Projects[333]

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
BioDiscovery Toronto & Technology Transfer Toronto	BioDiscovery Toronto and Technology Transfer Toronto will build the Toronto network for technology transfer -- for life sciences, physical sciences and information technology. They will provide a focal point for industry to access one of North America's leading biomedical research centres, including a single window into the eight academic health science centres in Toronto.	Lead: University of Toronto [Toronto] Partners: Centre for Addiction and Mental Health, Hospital for Sick Children, Mount Sinai Hospital, Ryerson University, St. Michael's Hospital, Sunnybrook Health Sciences Centre, Toronto Rehabilitation Institute, University Health Network.	$5,600,000
Ottawa Technology Transfer Network	An Eastern Ontario technology transfer network will be established in collaboration with PARTEQ Innovations in Kingston. This investment will help integrate six institutions and three industry-focused	Lead: University of Ottawa [Ottawa] Partners: University of Ottawa, Ottawa Health Research Institute (OHRI), Children's Hospital of Eastern Ontario (CHEO), University of Ottawa Heart Institute, Algonquin College, National Capital Institute of	$2,908,508

[333] *See*, Government of Ontario, "Ministry of Research and Innovation Report (July 21, 2006) (Ontario: MRI, 2006) online: http://www.mri.gov.on.ca/english/news/MarketReadiness072106_bd2.asp (last accessed on July 20, 2011)

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
	organizations into one network that will transition technologies to the private sector, and leverage research expertise in the Ottawa/Kingston regions to help get new technologies to market.	Telecommunications (NCIT), Ottawa Centre for Research and Innovation (OCRI).	
Expanding Commercialization Capacity in the Kingston Region	The PARTEQ Innovations technology transfer model will be expanded to all research institutions and two private sector research facilities in the Kingston area. The main focus will be on better connecting the research base at Queen's University and other institutions to industries in Eastern Ontario.	Lead: PARTEQ Innovations at Queen's University [Kingston] Partners: Kingston General Hospital, Royal Military College of Canada, St. Lawrence College, DuPont Canada, Novelist Global Technology Centre	$2,200,000
C4 Technology Transfer Offices	A Southwestern Ontario network for technology transfer will be expanded to leverage the expertise of associated regional innovation networks and other organizations to build strong linkages with the private sector.	Lead: McMaster University [Hamilton] Partners: University of Guelph, University of Waterloo, University of Western Ontario, University of Windsor, Wilfred Laurier University, Lawson Health Research Institute, Robarts Research Institute	$3,899,531

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
	The network will also include a process to link business and engineering students to companies to help bring products and services to market.		
Ontario Partnership for Innovation and Commercialization (OPIC)	A provincial network for technology transfer — comprised of seven universities — will be developed and linked to technology transfer expertise in Toronto (through Technology Transfer Toronto). These universities will leverage their local regional innovation network to help transition technologies to the private sector.	Lead: Ryerson University [Toronto] Partners : Brock University, Lakehead University, Laurentian University, Nipissing University, Trent University, University of Ontario Institute of Technology	$1,600,000
Colleges Ontario Network for Industry Innovation (formerly known as College Network for Industry Innovation)	A provincial network will be established with 10 Ontario colleges to help small companies solve technical problems, adapt new technologies, and develop or improve new products and processes.	Lead: Seneca College [Toronto] Partners: Algonquin College, Centennial College, Conestoga College, Fanshawe College, George Brown College, Humber Institute of Technical and Advanced Learning, Niagara College, St. Clair College, Seneca College, Sheridan Institute of Technical and Advanced Learning	$3,500,275

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
Ontario Society for Excellence in Technology Transfer (OnSETT)	A provincial training and internship program will be established and delivered across 31 member institutions. In addition, these members will have access to industry expertise to help them transition technologies to the private sector. The program will facilitate sharing of expertise and resources across the province.	Lead: Parteq Innovations at Queen's University [Kingston] Partners: McMaster University, Mount Sinai Hospital, Ottawa Health Research Institute, Queen's University, The Hospital for Sick Children, University of Western Ontario, University Health Network, University of Guelph, University of Ottawa, University of Toronto, University of Waterloo	$2,205,000
Talent First Network	This network will provide talented students and companies with the training, tools and methods required to help move technologies to private sector companies who can get them to the marketplace.	Carleton University [Ottawa]	$1,116,500
Strengthening Ontario's Industry Capacity in Photonics	The Ontario Photonics Innovation Network (OPIN) will: engage and promote the photonics industry sector, act as a gateway for industry to Ontario's research institutions, and act as an advisor for	Ontario Photonics Innovation Network [Midland]	$300,000

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
	innovative companies that wish to bring innovative ideas before investors. The photonics industry includes areas such as fiber optics, laser technology and imaging.		
Regional Innovation Development Program (RIDP)	The Regional Innovation Development Program (RIDP) will build business development capacity in Ontario's key technology clusters including Waterloo, Ottawa, and Toronto. Led by the Ottawa Centre for Research and Innovation (OCRI), this initiative will work to integrate technology transfer and commercialization, and also build collaborations between the information and communications technology sector and research institutions.	Led by the Ottawa Centre for Research and Innovation (OCRI) [Ottawa] with help from Communitech [Waterloo] and the Innovation Synergy Centre [Markham]	$3,400,000
Promoting Economic Development in the Medical and Assistive	Health Technologies Exchange (HTX) will implement developmental research projects that	Health Technologies Exchange (HTX) [Markham]	$600,000

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
Technologies (MAT) and Information and Communication Technologies (ICT) Sectors	can further the commercial application of new discoveries in the Medical and Assistive Technologies, and Information and Communication Technologies sectors. This will involve engaging teams of Ontario researchers to work with small and medium-sized businesses to solve product development issues.		
Building Commercialization and Investment Capacity in Ontario's Agri-Food, Life Sciences, and Bio-Products Sectors	BioEnterprise will undertake commercialization activities that focus on the Agri-Food, Life Sciences, and Bio-products sectors. Key features of the program will include: working with entrepreneurs to assist with business planning and financial strategies, and building stronger sector linkages between small and medium-sized businesses and research institutions.	BioEnterprise Corporation [Guelph]	$900,000
Ontario Internship Program	The Ontario Centres of Excellence, in	Ontario Centres of Excellence with Vitesse	$1,200,000

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
	partnership with Vitesse Re-Skilling, will develop the Ontario Internship Program. This program will place students and new graduates in Ontario technology companies over the next three years. Students will have the opportunity to develop commercialization skills, ideas and knowledge in an industry setting.	Re-Skilling [Ottawa]	
Southwestern Ontario Industry Engagement	TechAlliance will develop programs that will connect entrepreneurs to researchers to: help start new ventures; conduct market research to determine the potential saleable value of technologies; and assist small and medium-sized companies with business plan development.	TechAlliance [London]	$700,000
C3 Network	This program will establish a student mentorship program and engage industry in the new media sector (e.g. electronic gaming, etc.) A key	New Media Business Alliance [Toronto]	$300,000

Project Name	Project Description	Project Lead/Location & Partner Organizations	ORCP Funding
	goal of the program is to help retain Ontario's young, talented innovators by creating an entrepreneurial culture within the new media sector.		
Industry Receptor Capacity	The Ontario Centre for Environmental Technologies Advancement (OCETA) will bring together research institutions and industry to collaborate on research and development to help address technical issues in the development of a technology. The parties will develop strategies to commercialize products that address Canadian environmental priorities. OCETA will also help Ontario company's access markets, and will expand its business support services for companies with environment.	Ontario Centre for Environmental Technologies Advancement (OCETA) [Mississauga]	$1,000,000

Appendix B

B. Revenue Canada Provisions[334]

Pursuant to section 37 of the *Income Tax Act*, R.S.C. (1985) (5th supp.), c. 1, as amended, the Canada Revenue Agency provides incentives, in the form of income tax credits and income tax deductions for taxpayers to undertake SR&ED. SR&ED is defined in subsection 248(1) as follows:

...scientific research and experimental development means systematic investigation or search that is carried out in a field of science or technology by means of experiment or analysis and that is basic research, namely, work undertaken for the advancement of scientific knowledge without a specific practical application in view, applied research, namely, work undertaken for the advancement of scientific knowledge with a specific practical application in view, or experimental development, namely, work undertaken for the purpose of achieving technological advancement for the purpose of creating new, or improving existing, materials, devices, products or processes, including incremental improvements thereto, and, in applying this definition in respect of a taxpayer, includes work undertaken by or on behalf of the taxpayer with respect to engineering, design, operations research, mathematical analysis, computer programming, data collection, testing or psychological research where the work is commensurate with the needs, and directly in support, of the work described in paragraph (a), (b) or (c) that is undertaken in Canada by or on behalf of the taxpayer, but does not include work with respect to market research or sales promotion, quality control or routine testing of materials, devices, products or processes, research in the social sciences or the humanities, prospecting,

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[334] *See*, Industry Canada, online http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01638.html (last accessed on January 12, 2011).

exploring or drilling for, or producing, minerals, petroleum or natural gas, the commercial production of a new or improved material, device or product or the commercial use of a new or improved process, style changes, or routine data collection.

Section 127 (5) of the *Income Tax Act*, R.S.C. (1985) (5th supp.), c. 1, as amended, provides for Investment Tax Credit[335]

(5) There may be deducted from the tax otherwise payable by a taxpayer under this Part for a taxation year an amount not exceeding the lesser of

(a) the total of

(i) the taxpayer's investment tax credit at the end of the year in respect of property acquired before the end of the year, of the taxpayer's apprenticeship expenditure for the year or a preceding taxation year, of the taxpayer's child care space amount for the year or a preceding taxation year, of the taxpayer's flow-through mining expenditure for the year or a preceding taxation year, of the taxpayer's pre-production mining expenditure for the year or a preceding taxation year or of the taxpayer's SR&ED qualified expenditure pool at the end of the year or at the end of a preceding taxation year, and

(ii) the lesser of

(A) the taxpayer's investment tax credit at the end of the year in respect of property acquired in a subsequent taxation year, of the taxpayer's apprenticeship expenditure for a subsequent taxation year, of the taxpayer's child care space amount for a subsequent taxation year, of the taxpayer's flow-through mining expenditure for a subsequent taxation year, of the taxpayer's pre-production mining expenditure for a subsequent

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[335] *See*, ["Tax Act"], online : http://www.canlii.org/en/ca/laws/stat/rsc-1985-c-1-5th-supp/latest/rsc-1985-c-1-5th-supp.html (last accessed on October 30, 2011)

taxation year or of the taxpayer's SR&ED qualified expenditure pool at the end of the subsequent taxation year to the extent that an investment tax credit was not deductible under this subsection for the subsequent taxation year, and

(B) the amount, if any, by which the taxpayer's tax otherwise payable under this Part for the year exceeds the amount, if any, determined under subparagraph 127(5)(a)(i), and

(b) where Division E.1 applies to the taxpayer for the year, the amount, if any, by which

(i) the taxpayer's tax otherwise payable under this Part for the year

exceeds

(ii) the taxpayer's minimum amount for the year determined under section 127.51.

Appendix C

C. Federal SR&ED program on $5 million of qualified SR&ED expenditures

(all figures in $CAD)[336]

	SR&ED Expenditures	Credit Rate	% Refund	Refundable Tax Credit (Cash Back)	Non-Refundable Tax Credit (Reduce Taxes)
Small Canadian Controlled Private Corporations	First $3 million	35%	100%	$1,050,000	-
	Remaining $2 million	20%	40%	$160,000	$240,000
Total				$1210,000	$240,000
	SR&ED Expenditures	Credit Rate	% Refund	Refundable Tax Credit (Cash Back)	Non-Refundable Tax Credit (Reduce Taxes)
Large Public or Foreign Controlled Corporations	First $3 million	20%	-	-	$600,000
	Remaining $2 million	20%	-	-	$400,000
Total $1000,000					

[336] The table is an adaptation from ["FAITC – September 2010"] *supra* note 122 at 2.

Appendix D

D. Federal and Provincial SR&ED Tax Incentives[337]

Federal and Provincial SR&ED Tax Incentives for Small Canadian Private Corporations

Province	Provincial Credit		Federal Credit		Combined Credit Rate
	Rate	Refund?	Rate	Refund?	
Alberta	10%	Yes	35%	Yes	41.50%
British Columbia	10%	Yes	35%	Yes	41.50%
Manitoba	20%	Partial	35%	Yes	48.00%
New Brunswick	15%	Yes	35%	Yes	44.75%
Newfoundland and Labrador	15%	Yes	35%	Yes	44.75%
Nova Scotia	15%	Yes	35%	Yes	44.75%
Ontario	10%+4.5%	Yes/No	35%	Yes	44.43%
Prince Edward Island			35%	Yes	35.00%
Quebec	37.50%	Yes	35%	Yes	60.94%
Saskatchewan	15%	Yes	35%	Yes	44.75%
Nunavut	-	-	35%	Yes	35.00%
NWT	-	-	35%	Yes	35.00%
Yukon	15%	Yes	35%	Yes	44.75%

[337] The tables are an adaptation from ["FAITC – September 2010"] *supra* note 122 at 2.

Federal and Provincial SR&ED Tax Incentives for Large Public or Foreign-Controlled Corporations

Province	Provincial Credit		Federal Credit		Combined Credit Rate
	Rate	Refund?	Rate	Refund?	
Alberta	10%	Yes	20%	No	28%
British Columbia	10%	No	20%	No	28%
Manitoba	20%	Partial	20%	No	36%
New Brunswick	15%	Yes	20%	No	32%
Newfoundland and Labrador	15%	Yes	20%	No	32%
Nova Scotia	15%	Yes	20%	No	32%
Ontario	4.50%	No	20%	No	23.60%
Prince Edward Island			20%	No	20%
Quebec	17.50%	Yes	20%	No	34%
Saskatchewan	15%	Yes	20%	No	32%
Nunavut	20%			No	20%
NWT	-	-	20%	No	20%
Yukon	15%	Yes	20%	No	32%

Appendix E

E. 192 Member States of the UN Convention on Biological Diversity, 1992

(as of August 2011)

Afghanistan	Djibouti	Lebanon	Saint Kitts and Nevis
Albania	Dominica	Lesotho	Saint Lucia
Algeria	Dominican Republic	Liberia	Saint Vincent and the Grenadines
Angola	Ecuador	Libya	Samoa
Antigua and Barbuda	Egypt	Liechtenstein	San Marino
Argentina	El Salvador	Lithuania	São Tomé and Príncipe
Armenia	Equatorial Guinea	Luxembourg	Saudi Arabia
Australia	Eritrea	Republic of Macedonia	Senegal
Austria	Estonia	Madagascar	Serbia
Azerbaijan	Ethiopia	Malawi	Seychelles
Bahamas	European Union	Malaysia	Sierra Leone
Bahrain	Fiji	Maldives	Singapore
Bangladesh	Finland	Mali	Slovakia
Barbados	France	Malta	Slovenia
Belarus	Gabon	Marshall Islands	Solomon Islands
Belgium	The Gambia	Mauritania	Somalia
Belize	Georgia	Mauritius	South Africa
Benin	Germany	Mexico	Spain
Bhutan	Ghana	Federated States of Micronesia	Sri Lanka
Bolivia	Greece	Moldova	Sudan
Bosnia and Herzegovina	Grenada	Monaco	Suriname
Botswana	Guatemala	Mongolia	Swaziland
Brazil	Guinea	Montenegro	Sweden
Brunei Darussalam	Guinea-Bissau	Morocco	Switzerland
Bulgaria	Guyana	Mozambique	Syria
Burkina Faso	Haiti	Namibia	Tajikistan

Burma	Honduras	Nauru	Tanzania
Burundi	Hungary	Nepal	Thailand
Cambodia	Iceland	Netherlands	Timor-Leste
Cameroon	India	New Zealand	Togo
Canada	Indonesia	Nicaragua	Tonga
Cape Verde	Iran	Niger	Trinidad and Tobago
Central African Republic	Iraq	Nigeria	Tunisia
Chad	Ireland	Niue	Turkey
Chile	Israel	Norway	Turkmenistan
People's Republic of China	Italy	Oman	Tuvalu
Colombia	Jamaica	Pakistan	Uganda
Comoros	Japan	Palau	Ukraine
Democratic Republic of the Congo	Jordan	Papua New Guinea	United Arab Emirates
Republic of the Congo	Kazakhstan	Paraguay	United Kingdom
Cook Islands	Kenya	Peru	Uruguay
Costa Rica	Kiribati	Philippines	Uzbekistan
Côte d'Ivoire	Kuwait	Poland	Vanuatu
Croatia	North Korea	Portugal	Venezuela
Cuba	South Korea	Qatar	Vietnam
Cyprus	Kyrgyzstan	Romania	Yemen
Czech Republic	Laos	Russia	Zambia
Denmark	Latvia	Rwanda	Zimbabwe

Appendix F

F. Member States of the Group of 77

(As of August 2011)

Afghanistan	Singapore	Haiti	Mozambique
Algeria	Solomon Islands	Honduras	Myanmar
Angola	Somalia	India	Namibia
Antigua and Barbuda	South Africa	Indonesia	Nepal
Argentina	Sri Lanka	Iran	Nicaragua
Bahamas	Sudan	Iraq	Niger
Bahrain	Suriname	Jamaica	Nigeria
Bangladesh	Democratic Republic of the Congo	Jordan	Oman
Barbados	Djibouti	Kenya	Pakistan
Belize	Dominica	Kuwait	Palestine
Benin	Dominican Republic	Lao People's Democratic Republic	Panama
Bhutan	Ecuador	Lebanon	Papua New Guinea
Bolivia	Egypt	Lesotho	Paraguay
Bosnia and Herzegovina	El Salvador	Liberia	Peru
Botswana	Equatorial Guinea	Libyan Arab Jamahiriya	Philippines
Brazil	Eritrea	Madagascar	Qatar
Brunei Darussalam	Ethiopia	Malawi	Rwanda

Burkina Faso	Fiji	Malaysia	Saint Kitts and Nevis
Burundi	Gabon	Maldives	Saint Lucia
Cambodia	Gambia	Mali	Saint Vincent and the Grenadines
Cameroon	Ghana	Marshall Islands	Samoa
Cape Verde	Grenada	Mauritania	Sao Tome and Principe
Central African Republic	Guatemala	Mauritius	Saudi Arabia
Chad	Guinea	Micronesia	Senegal
Chile	Guinea-Bissau	Mongolia	Seychelles
China	Guyana	Morocco	Sierra Leone
Colombia	Swaziland	Tunisia	Venezuela (Bolivarian Republic of)
Comoros	Syrian Arab Republic	Turkmenistan	Viet Nam
Congo	Thailand	Uganda	Yemen
. Costa Rica	Timor-Leste	United Arab Emirates	Zambia
Côte d'Ivoire	Togo	United Republic of Tanzania	Zimbabwe
Cuba	Tonga	Uruguay	
Democratic People's Republic of Korea	Trinidad and Tobago	Vanuatu	