Innovation as Capability and Freedom: Charting a Course of TRIPS Patent Protection in a Fair and Balanced Global Innovation System

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Abstract

This research aims to substantiate the idea that innovation is a capability that can be cultivated for equitable development and that a user's freedom to innovate should not be violated by excessive intellectual property rights. The central feature of this idea is the principle of substantive equality of innovation capability, which is comprised of five components: equality of innovation opportunity, neutrality of innovation models, accessibility of the innovation commons, dignity of the entrepreneurial spirit, and respect for indigenous innovation. These five components will ensure that everyone has the basic innovation capability to function in the knowledge society and a real opportunity to access the innovation commons, mix her intellect with raw innovation resources, and participate in the decision-making process that affects her innovation capability and freedom.

This thesis envisions a fair and balanced global innovation system and proposes a two-pronged approach to incorporate the TRIPS patent regime into this system. To promote multi-dimensional and equitable development, an innovation capability approach to development aims to maximize the contribution of intellectual resources to economic growth and human development through cultivating innovation capability and harnessing the power of non-proprietary innovation models. To increase the effectiveness of innovation systems and promote democratic innovation governance, an innovation equality and freedom approach to the TRIPS patent regime advances distributive justice and intergenerational equality objectives of the global innovation regime.

A fair and balanced global innovation system has legal implications for both national governments and international institutions. A national government has the obligation to bring each and every citizen to a point of fair competition in the innovation market. This means that the government should provide equal opportunity to freely access the innovation commons and equally participate in the decision-making process that affects each person's innovation capability and freedom. In addition, an optimal system of innovation ought to be based on a complementary combination of proprietary and non-proprietary systems in order to produce the highest attainable rates of innovation, productivity, and social utility. For international institutions, I suggest that the WIPO may be a more appropriate forum than the WTO for global innovation governance.

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Chapter One: Introduction

1.1 TRIPS in an Innovation and Development Context

Intellectual property rights (IPRs) are exclusive rights in the creations of the mind,[1] whose stated purpose is often described as the promotion of innovation and development. Intellectual property laws had been subjected to national jurisdiction and had been implemented within geographical boundaries prior to the conclusion of the *Paris Convention for the Protection of Industrial Property*[2] and the *Berne Convention for the Protection of Literary and Artistic Works*.[3] For the first time, the Paris/Berne conventions "internationalized" the intellectual property system by introducing national treatment[4] and

[1] Article 2(1) of the *Agreement on Trade-Related Aspects of Intellectual Property Rights* provides that "'intellectual property' refers to all categories of intellectual property that are the subject of Sections 1 through 7 of Part II," which include copyright and related rights; trademarks; geographical indications; industrial designs; patents; layout-designs (topographies) of integrated circuits; and the protection of undisclosed information. See *Agreement on Trade-Related Aspects of Intellectual Property Rights*, 15 April 1994, *Marrakesh Agreement Establishing the World Trade Organization*, Annex 1C, 33 I.L.M. 1197, online: WTO <http://www.wto.org/english/docs_e/legal_e/27-TRIPS.pdf> (last visited 19 December 2012) [hereinafter "TRIPS Agreement" or "TRIPS"]. "Intellectual property" is defined in article 2(viii) of the 1967 *Convention Establishing the World Intellectual Property Organization* (*WIPO*) to include rights relating to: literary, artistic and scientific works; performances of performing artists, phonograms, and broadcasts; inventions in all fields of human endeavour; scientific discoveries; industrial designs; trademarks, service marks, and commercial names and designations; protection against unfair competition; and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields. See *Convention Establishing the World Intellectual Property Organization*, 14 July 1967, 6 I.L.M. 782, online: WIPO <http://www.wipo.int/export/sites/www/treaties/en/convention/pdf/trtdocs_wo029.pdf> (last visited 19 December 2012) [hereinafter "WIPO Convention"]. This definition seems overinclusive because "all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields" broadly include all productions and things outside the listed categories.

[2] *Paris Convention for the Protection of Industrial Property*, 20 March 1883, revised in Stockholm on 14 July 1967, 21 U.S.T. 1583, 828 U.N.T.S. 305, [*Paris Convention*], online <http://www.wipo.int/clea/en/text_pdf.jsp?lang=EN&id=4038> (last visited 19 December 2012).

[3] *Berne Convention for the Protection of Literary and Artistic Works*, 9 September 1886, revised in Paris on 24 July 1971, 828 U.N.T.S. 221 [*Berne Convention*], online: WIPO <http://www.wipo.int/export/sites/www/treaties/en/ip/berne/pdf/trtdocs_wo001.pdf> (last visited 19 December 2012).

[4] In general, national treatment requires that foreign nationals be treated no less favourably than nationals. See art. 3(a) of the *Paris Convention* and art. 5 of the *Berne Convention*. See also Georg Bodenhausen, *Guide to the Application of the Paris Convention for the Protection of Industrial Property as Revised at Stockholm in 1967,* (Geneva: United International Bureaux for the Protection of Intellectual Property, 1968) [Bodenhausen, Guide to the Application of the Paris Convention]; and WIPO, *Guide to the Berne Convention for the Protection of*

limited minimum standards, though with weak enforceability. The World Trade Organization's (WTO) *Agreement on Trade-Related Aspects of Intellectual Property Rights* (TRIPS) further internationalized the Paris/Berne-based intellectual property system by merging intellectual property with the international trade system. The introduction of the WTO as a new international intellectual property governance institution has "transformed both the substance and the process of international IP lawmaking."[5] One important – and arguably the most important – implication of incorporating intellectual property under the auspices of the WTO is the mandatory jurisdiction of the WTO's binding dispute settlement mechanism over any intellectual property dispute arising from the application or implementation of TRIPS. Compared with the dispute settlement procedures under the World Intellectual Property Organization (WIPO) administered conventions such as Paris and Berne,[6] the rule-based, legalized WTO dispute settlement system[7] provides "security and predictability to the multilateral trading system."[8]

Literary and Artistic Works (Paris Act, 1971), WIPO Publication No. 615(E) (Geneva: WIPO, 1978) [WIPO, Guide to the Berne Convention].

[5] Kal Raustialad, "Density and Conflict in International Intellectual Property Law" (2007) 40 U.C. Davis L. Rev. 1021 at 1021. See generally, Daniel J. Gervais, *The TRIPS Agreement: Drafting History and Analysis*, 3rd ed., (London: Sweet & Maxwell, 2008) [hereinafter "Gervais, *The TRIPS Agreement*"]; Peter Drahos & John Braithwaite, *Information Feudalism: Who Owns the Knowledge Economy*? (London, UK: Earthscan, 2002); Thomas Cottier & Petros C. Mavroidis, eds., *Intellectual Property: Trade, Competition, and Sustainable Development,* (Ann Arbor: University of Michigan Press, 2003); Susan K. Sell, *Private Power, Public Law: The Globalization of Intellectual Property Rights,* (Cambridge, UK: Cambridge University Press, 2003).

[6] For example, art. 28(1) of the Paris Convention provides that members can bring any dispute before the International Court of Justice. *Supra,* note 2 in chapter 1. However, art. 28(2) and art. 28(3) give members the choice to opt out if they do not wish to be bound by art. 28(1).

[7] The WTO's dispute settlement system is "arguably the most important systemic outcome of the Uruguay Round" and has been heralded as "the jewel in the crown" of the multilateral trading system. J.H.H. Weiler, "The Rule of Lawyers and the Ethos of Diplomats: Reflections on the Internal and External Legitimacy of WTO Dispute Settlement", (2001) 35 J.W.T. 191. Rochelle Cooper Dreyfuss & Andreas F. Lowenfeld, "Two Achievements of the Uruguay Round: Putting TRIPS and Dispute Settlement Together", (1997) 37 Va. J. Int'l L. 275. See generally, on the WTO dispute settlement system, William J. Davey, "WTO Dispute Settlement: Segregating the Useful Political Aspects and Avoiding 'Over-Legalization'" in Marco Bronckers & Reinhard Quick, eds., *New Directions in International Economic Law: Essays in Honour of John H. Jackson,* (The Hague: Kluwer Law International, 2000) at 291; Judith Goldstein *et al*., "Introduction: Legalization and World

The intellectual property system is an important public policy tool for the ultimate goal of promoting social, economic and technological development. The purpose of the patent system in particular is to create incentives for innovation and to contribute to the more efficient production of knowledge-based goods and the more equitable distribution of social benefits arising from these goods. In fact, the objective of the *TRIPS Agreement* as stated in article 7 is to promote "technological innovation … in a manner conducive to social and economic welfare …."

Despite this explicit statement of purpose, the high level of intellectual property protection embodied in TRIPS has adverse impacts on governments' ability to provide their citizens with key development resources such as adequate food, accessible education and affordable medicines. Skeptics argue that TRIPS implementation in countries without complementary industrial policies and regulatory controls on anti-competitive practices may result in substantial welfare losses coupled with little beneficial innovation.[9] Indeed, high levels of patent protection have served principally to transfer income from poor countries to rich countries and to contribute to undermining the development of some of the former. The situation is particularly severe in the least-developed countries where the scientific infrastructure and intellectual base have not yet reached the point where they can positively

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Politics" (2000) 54:3 International Organization 385 at 389; and Robert Hudec, *Enforcing International Trade Law: The Evolution of the Modern GATT Legal System,* (Salem, N.H.: Butterworth Legal Publishers, 1993).

[8] Article 3(2) of the *Understanding on Rules and Procedures Governing the Settlement of Disputes* (DSU), Annex 2 of the *Agreement Establishing the World Trade Organization*, signed in Marrakesh, Morocco, 15 April 1994, reprinted in (1994) 33 I.L.M. 81(entered into force 1 January 1995). See also, WTO Panel Report, *United States-Section 301-310 of the Trade Act of 1974* (WT/DS152/R, 22 December 1999) at para. 7.75 [US – Section 301].

[9] Ruth L. Gana, "Prospects for Developing Countries under the TRIPS Agreement", (1996) 29 Vand. J. Transnat'l L. 735 at 747; Robert Howse, "The Canadian Generic Medicines Panel: A Dangerous Precedent in Dangerous Times", (2000) 3 J. World I.P. 467 at 493.

respond to the incentives of patent protection. Thus, in these contexts, the social welfare costs of strong patent rights are likely to outweigh any potential benefits.[10]

It has been argued that TRIPS is suboptimal in terms of its ability to promote innovation in developing countries because (1) it takes little account of differences in development levels, cultural traditions and legal systems;[11] (2) it limits members' abilities to deny patent protection on certain types of products, to use reverse engineering to foster local adaptation and indigenous technology, to exempt patent protection to accommodate public policy objectives, to supply the market by granting compulsory licences, to practice parallel importation and to rely on other flexible terms in the use and enforcement of patent rights;[12] and (3) it ignores indigenous innovations that have been inherited from past generations and have been gradually improved through collective ingenuity and informal, communal and grassroots innovative practices.[13]

This thesis highlights other innovation-undermining aspects of TRIPS that for three main reasons make it suboptimal also in terms of promoting innovation in developed countries. First, TRIPS does not account for the values of equality and liberty that are promoted by means of an inclusive, dynamic and systematic innovation perspective; TRIPS

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[10] For a concise summary of the pros and cons of the TRIPS Agreement for developing countries, see Carlos A. Primo Braga & Carsten Fink, "The Economic Justifications for the Grant of Intellectual Property Rights: Patterns of Convergence and Conflict", (1997) 72 Chi.-Kent L. Rev. 439. See also, Frederick M. Abbott, "The WTO TRIPs Agreement and Global Economic Development" in Frederick M. Abbott & David J. Gerber, eds. *Public Policy and Global Technological Integration,* (London: Kluwer Law, 1997) 39 at 43-46.

[11] "TRIPS in fact restricts the freedom of developing countries from fine-tuning their patent systems in line with their level of techno-economic development." See WIPO, "The Impact of the International Patent System on Developing Countries: A Study by Getachew Mengistie" (August 15, 2003), A/39/13 Add.1, online: <http://www.wipo.int/meetings/en/doc_details.jsp?doc_id=17555> (last visited 19 December 2012).

[12] Reichman and Dreyfuss argue that "the TRIPS Agreement elevated patent standards universally [and] these standards challenged the technological catch-up strategies of all the developing countries and saddled them with social costs they are struggling to absorb." Jerome H. Reichman & Rochelle Cooper Dreyfuss, "Harmonization without Consensus: Critical Reflections on Drafting a Substantive Patent Law Treaty", (2008) 57 Duke L.J. 85 at 91.

[13] Doris Estelle Long, "Crossing the Innovation Divide", (2008) 81 Temple L. Rev. 507.

takes a narrow view of innovation as a technological novelty and discounts the economic, cultural, social and political dimensions of innovation as a vehicle for the achievement of equality and freedom. Beyond being a new technological artifact, innovation is also about the autonomy to grow one's intellectual capacity and the freedom to express one's unique identity by exercising upon one's original ideas and by associating oneself with a specific innovation community. Further, innovation is about equality of opportunity to acquire basic knowledge and skills from the public domain of science, to share good ideas with others, to gain fundamental entrepreneurial skills and to develop essential platforms, financial foundations, and capabilities to launch business ventures.

This thesis envisions TRIPS as a means to promote substantive equality of innovation capability and the freedom to innovate. It argues that TRIPS should be integrated into a global innovation system that aims to improve the innovation capability of all innovation actors, including innovators, users, and the general public. Innovators and users should both be the primary subject and beneficiary of a global innovation system and entitled to the fair distribution of the benefits resulting from innovation. The substantive equality of innovation capability and the freedom to innovate hold a collective dimension in applying to the general public.

The substantive equality of innovation capability requires that everyone should have access to the necessary innovation resources (e.g., an open and accessible innovation commons) to earn a decent living and participate as a dignified and contributing member in the knowledge society. The freedom to innovate is a fundamental freedom that is intended for all without distinction as to their innovation capabilities and models. In short, the TRIPS patent regime, as part of a fair and balanced global innovation system, should promote

intellectual growth and autonomous experience of self-actualization, while preserving the space for equal opportunity to innovate and innovation freedom.

Second, TRIPS relies on patent incentives to promote innovation and ignores the dynamic roles of governmental measures and alternative innovation models in incentivizing innovation. Innovation is perceived to be best promoted through a patent regime and the stronger the patent protection the more incentives for innovation. However, the patent regime is but one part of a broader regulatory system for protecting a healthy innovation environment. Therefore, the TRIPS patent regime should be integrated into a global innovation system that depends on both patent monopoly and non-proprietary incentives to enhance innovation capability and ensure innovation freedom.

TRIPS' technical limitation as a pre-Internet-era instrument renders it inadequate to take account of the new innovation models arising from post-TRIPS technological advancements and their impact on market organization and social production. In particular, TRIPS is inadequate to harness collaborative yet dispersed human ingenuity and employ the potential of open and user innovation for increasing productivity and social utility. As globalization has decentralized commercial exchanges and social construction, the Internet has decentralized information exchanges and knowledge construction. Thomas L. Friedman tells us that the world we live in is becoming increasingly "flat."[14] In Yochai Benkler's term,

[14] Thomas L. Friedman, *The World is Flat: A Brief History of the Twenty-First Century*, (New York: Farrar, Straus and Giroux, 2005). Friedman argues that globalization is driven by "the individuals who understand the flat world, adapt themselves to its processes and technologies." *Ibid*., at 215.

flat is triggered and sustained by a radical decentralization of physical, capital, and human capabilities.[15]

> The critical characteristic of the networked economy is a radical decentralization of physical capital necessary for the production, storage, distribution, and processing of information, knowledge, and culture. This decentralization has caused a radical distribution of the practical capability to act in these areas, creating new levels of efficacy for individuals, who increasingly shift from being consumers to being users and producers.[16]

The shifting position of individuals from knowledge consumers to knowledge users and producers in an innovation network has democratized innovation, as Eric von Hippel of the MIT Sloan School of Management has claimed.[17] What von Hippel means by "democratization" is the normative change and paradigm shift to recognize the central position of end-users participation and collaboration in a dynamic innovation process. Benkler captures the essence of the new social production mode as being commons-based rather than being dictated by conventional firm management or market incentives.[18]

> Commons-based peer production is a socio-economic system of production that is emerging in the digitally networked environment. Facilitated by the technical infrastructure of the Internet, the hallmark of this socio-technical system is collaboration among large groups of individuals, sometimes in the order of tens or even hundreds of thousands, who cooperate effectively to provide

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[15] Yochai Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom*, (New Haven, CT: Yale University Press, 2006), online: <http://www.benkler.org/Benkler_Wealth_Of_Networks.pdf> (last visited 19 December 2012). [The Wealth of Networks]

[16] Yochai Benkler, "The University in the Networked Economy & Society: Challenges and Opportunities" in Richard N. Katz, ed., *The Tower and the Cloud: Higher Education in the Age of Cloud Computing,* (Boulder, Co.: Educause, 2008) 59 at 60.

[17] Eric von Hippel, *Democratizing Innovation,* (Cambridge, MA: MIT Press, 2006), electronic version available under a Creative Commons Licence: MIT <http://mitpress.mit.edu/books/0262002744/0262002744.pdf> (last visited 19 December 2012). [Eric von Hippel, *Democratizing Innovation*]

[18] Yochai Benkler, "Coase's Penguin, or Linux and the Nature of the Firm", (2002) 112 Yale L. J. 369, online: The Yale Law Journal <http://www.yalelawjournal.org/images/pdfs/354.pdf> (last visited 19 December 2012). See also, Yochai Benkler, "Sharing Nicely: On Sharable Goods and the Emergence of Sharing as a Modality of Economic Production", (2004) 114 Yale L. J. 273, online: The Yale Law Journal <http://www.yalelawjournal.org/images/pdfs/407.pdf> (last visited 19 December 2012).

> information, knowledge or cultural goods without relying on either market pricing or managerial hierarchies to coordinate their common enterprise.[19]

In short, TRIPS rules and built-in flexibilities are premised on the traditional proprietary innovation model and thus inherently inadequate to accommodate new innovation models made possible by the Internet. Moreover, TRIPS subscribes to a particular model of market organization and political ideology—the liberal democratic model—and thus endorses the primacy of private property rights in intellectual production and capitalist market mechanism to promote innovation. TRIPS was negotiated when economic and political liberalism triumphed over other forms of government and, accordingly, market-based mechanisms of knowledge production and innovation promotion became the predominant influence in intellectual property policy-making. It would be difficult to imagine that TRIPS could have been successful in today's multipolar world especially after the 2008 financial crisis.[20]

TRIPS globalized a liberal conceptual framework and ideology of individual rights and private property as the basis for both economic production and social organization.[21] The underlying logic of the TRIPS patent regime is that only through recognizing patent as individual rights and private property can we secure individual liberty and promote market efficiency. In this sense, TRIPS is both a commercial tool to harness market profits from competitive advantages in intellectual production and an ideological declaration that individual rights and private property are indispensable for such intellectual production.

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[19] Yochai Benkler & Helen Nissenbaum, "Commons-Based Peer Production and Virtue", (2006) 14:4 Journal of Political Philosophy 394, online The New York University <http://www.nyu.edu/projects/nissenbaum/papers/jopp_235.pdf> (last visited 19 December 2012).

[20] See a critique of capitalism and excessive reliance on market production, Richard A. Posner, *A Failure of Capitalism: The Crisis of '08 and the Descent into Depression*, (Cambridge, MA: Harvard University Press, 2009).

[21] Kurt Burch, "Intellectual Property Rights and the Culture of Global Liberalism", (1995) 17:2 Science Communication 214 at 215.

However, intellectual property rights, as a market-based mechanism to encourage creativity and innovation, are not the only incentives for the creation and dissemination of new knowledge. Traditionally, governments have used subsidy, prize, tax reduction, and other incentives to support scientific discovery and basic research. In fact, the excessive reliance in TRIPS on proprietary interests to incentivize innovation largely ignores the potential of open innovation systems to augment or even outperform proprietary models of innovation. Further, TRIPS is largely premised on tradable market value and discards social values and public interest in sectors of fundamental significance such as health, education, and environment. As such, the market fundamentalist approach threatens human survival, ingenuity, and prosperity in under-represented societies and endangers the legitimacy and effectiveness of the international intellectual property system itself. Moreover, TRIPS favours the private interests of large corporate IP holders over the public interests of intellectual property consumers and contributes more to the rent transfer to multinational corporations than technological advancement and economic development in either developed or developing countries.[22]

Third, the mechanic application of WTO trade rules in the protection and promotion of intellectual property rights, particularly in TRIPS interpretation by dispute settlement panels and the Appellate Body (AB), does not appreciate the fundamental differences between intellectual property goods and other goods. As a result, TRIPS is suboptimal to

[22] See Amy Glass & Xiaodong Wu, "Intellectual Property Rights and Quality Improvement", (2007) 82 Journal of Development Economics 393-415; Jean O. Lanjouw, "The Introduction of Pharmaceutical Product Patents in India: 'Heartless Exploration of the Poor and Suffering'?" NBER Working Paper No. 6366, 1997; Keith E. Maskus, *Intellectual Property Rights in the Global Economy*, (Washington, D.C.: Institute for International Economics, 2000), available online: <http://bookstore.piie.com/book-store/99.html>; Phillip McCalman, "Reaping What You Sow: An Empirical Analysis of International Patent Harmonization", (2001) LV Journal of International Economics 161-186.

promote innovation without a different interpretation framework to reconcile the tension between trade and intellectual property systems.

For these reasons, the TRIPS vision of exclusive, privilege-based, proprietary promotion of innovation restricts member state's capability and freedom to innovate; suppresses the inherent human nature and basic human right to grow intellectually; and thus under-exploits the most valuable resource—intellectual resource or human ingenuity. This TRIPS vision also stifles cumulative innovation by denying users and future innovators access to a vibrant innovation commons and a dynamic public knowledge domain. Finally, this TRIPS vision restricts the adaptive and self-generative capability of the potential innovators to innovate, is not conducive to intellectual collaboration and information exchange, is not tolerant of indigenous knowledge systems, and fails to promote public deliberation and democratic participation in global innovation governance and knowledge management. In short, given the limitations and problems identified above, TRIPS is suboptimal in promoting innovation and development in both developing and developed countries.

1.2 A Two-Pronged Approach to Innovation and Development

This thesis proposes a two-pronged approach for incorporating the TRIPS patent regime into a fair and balanced global innovation system as the foundation for equalizing the development divide and stimulating innovation potentials. To promote multidimensional and equitable development, an innovation capability approach to development aims to maximize the contribution of intellectual resources to economic growth and human development through cultivating innovation capability and harnessing the power of alternative modes of

innovation. To increase the effectiveness of innovation systems and promote democratic innovation governance, an innovation equality and freedom approach to the TRIPS patent regime advances distributive justice and intergenerational equality objectives of the global innovation regime.

1.2.1 Innovation Capability Approach to Development

At the outset, I define development not as an economic concept that focuses predominantly on growth, but as a human rights-based notion of substantive equality in development opportunities and distributive justice in development resources. As the focus of international law shifts from state relations to human welfare, the right to inclusive and multidimensional human development has been endorsed as a fundamental human right and gradually moved to the mainstream development discourse. I build my analysis on two categories of development literature: (1) the capability approach to development that is associated most prominently with the work of Amartya Sen and Martha Nussbaum;[23] and (2) the application of the capability approach in copyright, information privacy,[24] and global intellectual property regime.[25]

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[23] Amartya Sen's initial statement of this "capabilities approach" is in Amartya Sen, "Equality of What?" in Sterling McMurrin, ed., *Tanner Lectures on Human Values,* Vol. I. (Cambridge, UK: Cambridge University Press, 1980), reprinted in Amartya Sen, *Choice, Welfare, and Measurement* (Oxford, UK: Basil Blackwell, 1982). See also, Martha C. Nussbaum, "Capabilities and Human Rights", (1997) 66 Fordham Law Review 273; and Martha Nussbaum, "Human Rights and Human Capabilities", (2007) 20 Harv. Hum. Rts. J. 21.

[24] Julie E. Cohen, *Configuring the Networked Self: Law, Code, and the Play of Everyday Practice*, (New Haven, Conn.: Yale University Press, 2012).

[25] See Margaret Chon, "Intellectual Property and the Development Divide", (2006) 27 Cardozo L. Rev. 2821 at 2823 [Chon, "Intellectual Property and the Development Divide"]; see also, Margaret Chon, "Substantive Equality in International Intellectual Property Norm-Setting", in Daniel Gervais, ed., *Intellectual Property, Trade and Development*, (Oxford, UK: Oxford University Press, 2007) [Chon, "Substantive Equality in International Intellectual Property Norm-Setting"]; Madhavi Sunder, "Intellectual Property and Development as Freedom," in Neil Weinstock Netanel, ed., *The Development Agenda: Global Intellectual Property and Developing Countries*, (New York: Oxford University Press, 2009) [Sunder, "Intellectual Property and Development as Freedom"].

Sen argues that development's end goal is to empower people with certain human capabilities, such as the capability to live a healthy and long life and have access to education, while securing core freedoms, such as the freedom to participate in political life. Sen posits that enhancing capability and freedom is the most efficient way to realize the general welfare.[26]

Supplementing Sen's capability approach to development, I contend that "innovation capability" is one of the fundamental capabilities for modern human beings to function in the knowledge economy. Conceiving innovation capability from broad technological, institutional, cultural, and social dimensions, I argue that innovation capability is driven not only by technological development, but also by business model transformation, institutional change, norm-shifting in open and collaborative innovation culture, and social interaction of innovation networks. I propose that innovation capability should be based on an input-output/cost-benefit analysis of the innovation market. The essence of the capability approach is to develop a nation through empowering its people and providing them with all the opportunities to develop their potentials and realize their self-worth. The essence of an innovation capability approach to development is to enhance both efficiency (productivity improvement and economic growth) and equality (human welfare and equal access to development opportunities) of development policies through channeling collaborated ingenuity into intellectual production and cultivating innovation capability in the knowledge-based global economy.

Applying a substantive equality principal, underdevelopment is a result of the systemic subordination of, as well as the institutional discrimination against, developing

[26] Amartya Sen, *Commodities and Capabilities*, (Amsterdam: North-Holland, 1985).

countries in the global economic order and the intellectual property regime. TRIPS minimum standards and national treatment are based on formal equality and have discriminatory effects on members with lesser innovation capability. Therefore, I propose that special and differential treatment should be recognized as one of the fundamental principles of a transnational innovation infrastructure.

1.2.2 Ensuring Equal Innovation Opportunity and the Freedom to Innovate

Innovation freedom is the freedom to act upon, incorporate, and eventually transform knowledge in the public domain to novel solutions to technological, commercial, and social problems. It is fair to state that any unjustified restraints on the freedom to innovate are no less limiting than the lack of other types of freedoms. Therefore, I add innovation freedom to Sen's list of substantive freedoms and argue that the "freedom to innovate" lies at the heart of the substantive freedoms that the capability approach advocates for. In addition, ensuring innovation freedom is an important way to overcome TRIPS limitations.

The freedom to innovate is not merely the absence of interference with innovative activities but also the affirmative creation and provision of the right innovation conditions. The freedom to innovate aims to ensure equal access to innovation opportunity, provide essential tools to facilitate interactive learning and information sharing, empower intellectually and culturally marginalized, and unleash the power of entrepreneurship. A government fails to secure the freedom to innovate and ensure substantive equality of innovation opportunity not only when it restricts or interferes with innovative efforts, but also when it permits its citizens to suffer various forms of innovation capability deprivation and innovation unfreedoms.

My analysis of innovation freedom relies also on critical innovation literature on global innovation governance, most linked to Eric von Hippel's user innovation, Yochai Benkler's commons-based peer production, and Katherine Strandburg's application of user and open innovation in TRIPS context. Eric von Hippel observes that "users of products and services—both firms and individual consumers—are increasingly able to innovate for themselves."[27] Examples of user innovation, ranging widely from open source software to scientific research tools, are particularly important to enhance developing countries' innovation capability due to their cost-effectiveness. Yochai Benkler argues that in a networked knowledge economy, human capabilities and national welfare are critically dependent on the core inputs of information, knowledge, culture, and innovation.[28] Katherine Strandburg argues that TRIPS, as a trade liberalization instrument, is inherently inadequate to promote new innovation models because it reflects a "sales-oriented, mass market" view of innovation which facilitates manufacturers gain comparative advantage by producing mass market goods in one location and selling them in another.[29]

1.2.3 Integrating TRIPS into a Fair and Balanced Global Innovation System

The global innovation landscape has been profoundly changed by the entry into force of the TRIPS patent provisions and their implementation by WTO members. The predominant focus on incentivizing innovation through the expansion of patent protection in terms of protectable subject matter, scope, strength, duration, and geographic coverage has shifted the balance between the patent system and non-proprietary innovation systems

[27] Eric von Hippel, *Democratizing Innovation, supra,* note 17 in chapter 1, at 1.
[28] Yochai Benkler, *Wealth of Networks*, *supra,* note 15 in chapter 1, at 302.
[29] Katherine J. Strandburg, "Evolving Innovation Paradigms and the Global Intellectual Property Regime", (2009) 41 Conn. L. Rev. 861 at 889-890.

towards the former. This imbalance has pernicious impacts on the allocation of innovation resources and distribution of innovation benefits between and among the world population. In addition, the imbalance adversely affects developing countries more than developed ones in the pursuit of sustainable environmental, economic, and social development. Therefore, a global innovation system should coordinate, steer, and facilitate the flow of innovation resources towards a desirable combination of innovation incentives. TRIPS has an important role to play within the global governance of innovation by ensuring the substantive freedom to innovate of the world's current and future innovators.

A global innovation system broadly refers to the regulatory framework for cultivating innovation capability and deploying intellectual resources to transform physical and financial resources into new and valuable processes, products, and services. In essence, a global innovation system aims to enhance innovation capabilities in a sustained manner while optimizing the exploitation of innovation resources; driving the development of human ingenuity; fostering knowledge exchange and open and collaborative innovation; and cultivating a vibrant innovation commons.

The primary theoretical approach used to support my propositions is a global theory of justice in knowledge production that is informed by human rights norms and distributive justice in global governance. As Rawls contends: "For us the primary subject of justice is the basic structure of society, or more exactly, the way in which the major social institutions distribute fundamental rights and duties and determine the division of advantages from social cooperation." [30] These perspectives deepen the analysis of multi-dimensional

[30] See John Rawls, *A Theory of Justice*, (Cambridge, MA: The Belknap University Press, 1971) at 7.

relationship of patent protection and innovation that are further complicated by international patent regime and networked information society.

1.3 Research Methodology

Studies of the global regulatory order for innovation have been divided along disciplinary lines: international relations scholars have focused on political power and national interests in the making and breaking of international regimes; international intellectual property law scholars have focused on TRIPS implementation, interpretation and enforcement; and business management scholars have focused on emerging innovation trends and how to leverage innovation advantages in the global marketplace.

While these studies advance our understanding of the international intellectual property regime and its impacts on the distribution of development resources and innovation capabilities, I believe a more integrated approach is required in formulating an international innovation policy and constructing a global innovation system.

To this end, this thesis adopts a multidisciplinary approach to bring together often isolated areas of literature under the same tenet: international intellectual property law, international relations, development policy, innovation studies, and global governance informed by an egalitarian justice perspective. Drawing from separate theoretical discourses creates new connections between them and facilitates further understanding of the global innovation paradigm through them. The interdisciplinary approach broadens both the scope of research and perspectives of analysis. It is the humble hope of the author that a new conceptual and normative framework emerges from the interdisciplinary approach to inform future discourse on innovation and development.

1.4 Thesis Structure

This thesis consists of seven chapters. Chapter One discusses the effectiveness of TRIPS in promoting innovation and the need for integrating the TRIPS patent regime into a global innovation system.

Chapter Two discusses the dynamic and systematic characters of innovation and introduces a multi-disciplinary and purpose-centred definition of innovation. Further, it posits that innovation, as an intrinsic public good, can equalize the distribution of social welfare and contribute to social justice. Finally, it suggests that patent law should be better seen as part of a dynamic innovation system to promote social progress and inclusive development as opposed to a branch of intellectual property law to only serve individuals' economic interests and facilitate monopoly rent extraction. Thus, the design of the patent system should be informed by innovation theories and account for substantive equality of innovation capability and users' freedom to innovate.

Chapter Three first points out that the concept of "development" has evolved from a pure economic concept that focuses predominantly on growth to a human rights based notion of substantive equality in development opportunities and distributive justice in development resources. Drawing upon Sen and Nussbaum's capability approach to development, I adopt an organic definition of development as empowerment and enlargement of freedoms and capabilities. In this sense, development is treated both as an engine of change and as an end-goal in itself. I propose an innovation capability approach to development, which aims to promote equitable economic growth and human development through cultivating innovation capability and substantiating the freedom to innovate. Chapter Three further analyzes the

role of an innovation capability approach in equalizing development gaps and highlights the significance of distributive justice both intergenerationally and globally.

Chapter Four provides a normative and positive analysis of the role of patents in fostering innovation for development and suggests ways in which the patent system can be integrated into an innovation system which depends on both patent monopoly and non-proprietary incentives, such as government prize and open innovation. Further, it argues that the purpose of patent is to enhance innovation capability of the current and future innovators and ensure the freedom to determine the mode and direction of innovation. As such, a national government should secure the "freedom to innovate" of its citizens by providing them with equal opportunity to cultivate their innovation capabilities and eliminating barriers to exercise their innovation capabilities. Moreover, it suggests an inclusive method to evaluate the effectiveness of patent in promoting innovation which includes economic, cultural, social, and political dimensions. Finally, it contends that the patent system should equally distribute innovation resource and opportunity at least to the point of guaranteeing everyone has access to the necessary innovation resources (e.g., building block of knowledge) to be able to earn a decent living and participate as dignified and contributing members in the knowledge society. An innovation capability approach to patent protection overcomes the limitations of a purely market-based analysis of costs and benefits of the patent system and complements the existing patent theories with an integrative, cooperative, cumulative and dynamic account of innovation-promotion and knowledge-production process. In a well-balanced innovation system, patents should function as but one carefully balanced and optimally productive instrument to generate, order, and distribute commercial, technological, and social justice interests at large.

Chapter Five envisions a fair and balanced global innovation system that secures "the freedom to innovate" of the world citizens by providing them with equal opportunity to cultivate their innovation capabilities and eliminating barriers to exercise their innovation capabilities. A fair and balanced global innovation system should enable everyone to have at least the basic innovation capability and freedom to exercise her intellect in innovation production and receive an adequate compensation that is fair to their investments while preserving their intellectual dignity and moral rights. Financial reward is a popular type of compensation, but an innovator should be free to choose any compensatory mechanism he prefers or forego his compensation altogether if he so desires. I argue that the existing instruments and institutions undergirding the international framework for promoting innovation should be adjusted to accommodate the emerging innovation models in the shifting global innovation paradigm. Further, Chapter Five examines the five main problems that have caused the underperformance of the TRIPS patent regime in enhancing innovation capability and suggests that the TRIPS patent regime should be integrated into an optimal global innovation system.

Chapter Six analyzes the legal implications of a global innovation system on the TRIPS patent regime and puts forward policy recommendations for TRIPS implementation, interpretation and enforcement. It envisions a global framework for democratic innovation governance that enables global citizens to participate in legislative debate and policy development that affect their basic innovation capability and freedom. Further, it proposes implementation strategies for national governments to maximize the potential of TRIPS to enhance social justice and innovation welfare for inclusive development. In addition, it

proposes institutional arrangements for democratic governance of the global innovation system—WIPO should become UN's innovation agency for development.

Chapter Seven summarizes the main thesis arguments and suggests that the innovation capability and freedom approach can be applied in other branches of intellectual property law and provides a new perspective for future research on innovation, development, and intellectual property.

Chapter Two: The Values and Dynamics of Innovation

Innovation is rightly seen as a key to technological, economic, cultural, and social development. Technological innovation increases productivity and is the main source of economic growth within modern capitalism;[1] business model innovation increases the efficiency of the allocation of resources and profit margins; mass communicational and social relational innovation in information exchange and knowledge dissemination enriches culture; and finally, innovation in how the governance framework functions to engage the citizenry in the public deliberation and democratic participation of building a supportive innovation infrastructure promotes equality and freedom.

Notwithstanding the significance of innovation to development, the meanings and dynamics of its occurrence remain implicit. This chapter aims to advance our understanding of what innovation entails and the dynamics of innovation models in different technological sectors and industrial contexts. Furthermore, it takes a systematic approach to innovation governance and highlights the normative function and social values of innovation as a public good. Finally, it suggests that patent law is better seen as part of a dynamic innovation system to promote social progress and inclusive development, as opposed to a branch of intellectual property law to serve individuals' economic interests and facilitate monopoly rent extraction. Thus, patent law and policy should be interpreted in conjunction with insights from innovation studies and other bodies of law, such as competition and human rights law; and applied in a manner that is sensitive to broader societal objectives, such as

[1] Joseph A. Schumpeter, *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle,* (Cambridge, MA: Harvard University Press, 1934).

promoting substantive equality of innovation capability and ensuring users' freedom to innovate.

This chapter is structured as follows: Section One reviews different innovation definitions and suggests a multi-disciplinary and purpose-centred definition of innovation. Section Two discusses the public-good character of innovation and how the distributive and equalizing effects of innovation can contribute to enhance social welfare and close the development gap. Section Three analyzes the dynamics of open, cumulative, user, and indigenous innovation models, as well as their implications on the design of the patent system and development strategy. Section Four elaborates on a multi-faceted system of innovation. Section Five concludes the chapter by calling for an innovation-promoting patent system for equitable and inclusive social development.

2.1 The Definition of Innovation

Innovation is traditionally categorized into technical innovation (e.g., a new drug) and non-technical innovation (e.g., a new business model). The former addresses the technological dimension of innovation and the latter addresses the commercial dimension of innovation. The dictionary definition indicates that innovation refers to a process to bring novelty in technological and commercial fields.[2] Further, the Government of Canada's reports on innovation entitled, "Achieving Excellence" and "Knowledge Matters", focus mainly on technological and commercial innovation for industry and economic

[2] For example, the *Oxford English Dictionary* (OEC) defines "innovation" as "1. a. The action of innovating; the introduction of novelties; the alteration of what is established by the introduction of new elements or forms," and "2. a. A change made in the nature or fashion of anything; something newly introduced; a novel practice, method, etc." See *Oxford English Dictionary*, "innovation" available online: <http://www.oed.com/>.

development.[3] In short, innovation is perceived as new technological ideas or creative commercial products or processes to be introduced into the market. The social, political, behavioral, and governance dimensions of innovation have rarely been studied comprehensively in the past.

In this section, I will examine the technological and commercial dimensions of innovation before discussing the social dimension of innovation. I will conclude this section with a proposal to rethink innovation from the purposes it aims to achieve, informed by multidisciplinary insights. The purpose-centred definition of innovation provides explicit mandates for the patent institution and normative framework for innovation governance. Moreover, the purpose-centred definition of innovation prepares the ground for policy initiatives to address rules, practices, and institutions besides patents (such as competition law and tax law) and broader reforms of government measures to remove regulatory, institutional, or competitive obstacles to innovation.

2.1.1 The Technological Dimension of Innovation

At the outset, it is important to differentiate between invention and innovation. Invention refers to the creation of new scientific knowledge or a technical idea that can lead to a new or improved product or process, whereas innovation is considered as the practical application and commercialization of the invention.[4] As J. A. Allen noted, "Innovation is the

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[3] *Achieving Excellence: Investing in People, Knowledge and Opportunity,* (Ottawa, ON: Government of Canada, 2002); *Knowledge Matters: Skills and Learning for Canadians,* (Ottawa, ON: Government of Canada, 2002). See also, Virginia Holden, "Recipes for Recovery: Creating Innovative Governance and Economic Development Policy for Canada's Declining Communities," Master of Science thesis in Planning submitted to the University of British Columbia, 2004, at 19.

[4] William Kingston, "Why Patents Need Reform, Some Suggestions for it," in Christopher Arup & William van Caenegem, *Intellectual Property Policy Reform: Fostering Innovation and Development*, (Cheltenham, UK: Edward Elgar, 2009) at 22. [Arup & Caenegem, *Intellectual Property Policy Reform*]

bringing of an invention into widespread, practical use… Invention may thus be construed as the first stage of the much more extensive and complex total process of innovation."[5] Similarly, Schumpeter maintains that invention and innovation are not synonymous terms because "the making of the invention and the carrying out of the corresponding innovation are, economically and sociologically, two entirely different things."[6] In other words, innovation requires both invention and its commercial exploitation, best epitomized by the development of marketable products.

Technological innovation is to solve technological problems in the physical world through the accumulation of scientific and technical knowledge. It can be both radical and incremental: radical innovations, such as new and effective vaccines, have saved millions of lives and improved overall health conditions worldwide, whereas incremental innovations, such as gradual improvements in crop rotation or irrigation schemes, can also provide solutions to pressing developmental problems.[7]

Moreover, technological innovation includes not only the creation and improvement of new technologies, but also the dissemination, application, and adaptation of existing technologies in a new context.[8] In other words, technological innovation does not necessarily mean technological sophistication; it can also include applying scientific information and

[5] 1967 Science Innovation & Industrial Property, at 8, cited in Oxford English Dictionary, *supra,* note 2 in chapter 2.
[6] Joseph A. Schumpeter, *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*, (New York: McGraw-Hill, 1939) at 84-86.
[7] OECD, *Meeting Global Challenges through Better Governance: International Co-operation in Science, Technology and Innovation*, (Paris: OECD, 2012) at 27-28, available online: <http://dx.doi.org/10.1787/9789264178700-en>.
[8] "The ability to adapt, therefore, is a significant step in technological empowerment, which over a period of time, can lead to the creation of knowledge generation capabilities amongst actors that are demand-driven rather than simply those that aim to replicate the successes of other regions of the world." UNCTAD, *Technology and Innovation Report 2010: Enhancing Food Security in Africa through Science, Technology and Innovation*, UN Doc. UNCTAD/TIR/2009, online: <http://www.unctad.org/en/docs/tir2009_en.pdf>. (last visited 19 December 2012).

adapting technologies to suit the local context, which is particularly important to developing countries.[9] Given the fact that developing countries undertake relatively less formal innovative activities (e.g., R&D) than developed countries, the capability to adopt and adapt existing technologies to their specific local context is the primary way by which technological innovation improves their economic growth and welfare.[10] In order to facilitate technology absorption and innovation capability building, every country needs a specifically designed innovation system.[11]

2.1.2 The Commercial Dimension of Innovation

The definition of innovation can not be considered complete without addressing the commercial dimension of innovation, which has been approached from various disciplines and perspectives. From an evolutionary economics perspective, innovation is the process whereby a firm introduces new technology and applies new business models into the economy.[12] Schumpeter posits that innovation is an endogenous process of introducing new products, new methods of production, or new combinations of existing ones to the production system; and thus creatively destructing old industries and economic orders.[13] For Schumpeter, the process by which innovations challenge and replace existing products, services, and business models is an essential part of capitalism.[14] According to his observations, innovation is essentially a process of "creative destruction": in order to survive economically, an innovative individual entrepreneur or firm systemically brings new

[9] World Bank, *Innovation Policy: A Guide for Developing Countries*, (Washington, D.C.: World Bank, 2010).
[10] Howard Pack & Larry E. Westphal, "Industrial Strategy and Technological Change", (1986) 22:1 Journal of Development Economics 87-128.
[11] Rajah Rasiah, "TRIPS and Capability Building in Developing Economies: Critical Issues", (2003) 33:3 Journal of Contemporary Asia 338 at 343.
[12] *Supra,* note 6 in chapter 2.
[13] *Supra,* note 1 in chapter 2 at 158.
[14] Joseph Schumpeter, 3d ed., *Capitalism, Socialism and Democracy*, (Harper & Brothers, 2006) at 83.

technologies and products, improvements in product quality or a reduction of production costs into the economy, thereby destroying stagnant firms.[15] Joseph Schumpeter identifies five types of innovation: new goods (products), new methods of production (processes), new markets, new sources of supply, and new ways of organizing businesses.[16]

From a managerial economics perspective, the latest Oslo Manual defines an innovation as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations."[17] According to this definition, there are four types of innovation: product innovation, process innovation, marketing innovation, and organizational innovation.[18] A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses.[19] A process innovation is the implementation of a new or significantly improved production or delivery method.[20] A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product

[15] According to Schumpeter, creative destruction "incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one." *Supra* note 6 in chapter 2, at 1033. See also his earlier article, "The Instability of Capitalism" published in 38 Economic Journal 361-366 (Sept. 1928), edited by John Maynard Keynes. The essay is reproduced in Joseph A. Schumpeter, *Essays on Entrepreneur, Innovation, Business Cycles, and the Evolution of Capitalism*, Richard Clemence ed., (Addison-Wesley, 1951) at 47-72.
[16] *Ibid*. at 66.
[17] Organization for Economic Cooperation and Development (OECD), *The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data—Oslo Manual*, 3rd ed., (OECD and Eurostat, 2005) ["Oslo Manual"].
[18] *Ibid*.
[19] *Ibid*. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics. Product innovations can utilize new knowledge or technologies, or can be based on new uses or combinations of existing knowledge or technologies.
[20] *Ibid*. This includes significant changes in techniques, equipment and/or software. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.

placement, product promotion or pricing.[21] An organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.[22] All innovations must contain a degree of novelty, which can be new to the firm, new to the market, or new to the world.[23]

2.1.3 The Social Dimension of Innovation

Innovation is much broader than technological invention or commercial innovation. Our understanding of innovation has gone beyond the technological and commercial spheres to enter the social sphere. Social innovation is understood as a broad term that contains multiple dimensions: behavioral, cultural, organizational, structural, institutional, political, and regulatory innovation. A myriad of subjects are of pivotal importance to social innovation, particularly intellectual property rights, education and training, organizational change, institutional framework, technological standards, etc.[24]

It is important to make the relationship between technical and social innovation mutually beneficial. An enabling social environment is a critical prerequisite to technological innovation. For example, Schumpeter posits that social innovation is a necessary condition for the efficacy of technological innovation. On the other hand, technological innovation has a great impact on social innovation and should be employed in such a way that it facilitates dynamic social exchange, cultivates an open and collaborative social environment, and

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[21] *Ibid*. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales.
[22] Organizational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labour productivity), gaining access to non-tradeable assets (such as non-codified external knowledge), or reducing costs of supplies. *Ibid*., at 47-51.
[23] *Ibid*., at 57.
[24] Susana Borrás, *The Innovation Policy of the European Union: From Government to Governance*, (Cheltenham, UK: Edward Elgar, 2003) at 2.

builds serendipitous social connections – all of which are important to build systemic and widely distributed innovation capabilities. In particular, collaborative technologies can harness the power of social networks and transform the ways in which social change takes place. Twitter-enabled live updates of vote counting in Singapore[25] and Wiki-enabled knowledge creation and sharing are two good examples. Users of social media have profoundly changed how information is produced and disseminated over the Internet, and, perhaps more importantly, the nature and channel of civic engagement and democratic participation.

2.1.4 A Purpose-Centred Definition of Innovation

From the above discussion on different definitions of innovation in economics, technology policy, and business management, innovation can be seen as a multi-dimensional concept, which involves three underpinning elements: (1) the necessary actors, institutions and organizations; (2) the creation and dissemination of knowledge and skills; and (3) new and useful products, services, and processes.

Arguably, it would not be desirable to study a multi-faceted subject such as innovation from one particular discipline without also considering critical insights from other fields. Therefore, I adopt useful perspectives from different disciplines and distill the common denominators of the characteristics of innovation process and the purposes that innovation aims to achieve. Innovation capability can be seen as the capability to generate new ideas to solve technological, commercial, and social problems. The purpose of

[25] Singapore Election @sgelection, available online: TWITTER, <http://twitter.com/#!/sgelection> (last visited August 31, 2012).

innovation is to increase living standards and enrich human lives by addressing challenges or solving problems in a better way.

I propose to define innovation as the introduction or application of a new idea, technology, practice, process, to alter the nature of established practices, in order to fulfill one or more of the following objectives:

- Reduce production costs or streamline the processes of production or service delivery
- Create new information or increase the quality of information
- Obtain competitive advantages or monopolistic control (successful innovation bestows monopoly profits upon the innovator)
- Enhance human core capabilities and substantiate substantive freedoms
- Improve transparency, accountability, democratic participation in the innovation decision-making processes
- Enlarge social opportunities

2.2 The Public Good Character of Innovation

This section discusses the public good character of innovation and how the distributive and equalizing effects of innovation can contribute to enhance social welfare and close the development gap.

2.2.1 Characteristics of Public Goods

Economists categorize goods into four types according to their rivalrousness and excludability: private goods, common-pool goods, club goods, and public goods.[26] A public

[26] Charlotte Hess & Elinor Ostrom, eds., *Understanding Knowledge as a Commons: from Theory to Practice*, (Cambridge, MA: MIT Press, 2007). Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for*

good is "a good that no consumer can be excluded from using if it is supplied, and for which consumption by one consumer does not reduce the quantity available for consumption by any other."[27] In contrast, a private good is any good or service which is rivalrous and excludable.[28] In the following discussion, the concepts of "private good" and "public good" are used in their ideal forms, although in practice it is difficult to find pure private goods or pure public goods which exactly satisfy the above definitions.

Table 1 gives a few examples of each type of goods.[29]

	Excludable	Non-excludable
Rivalrous	Private goods (cars, houses, computers, MP3 players, bananas)	Common-pool goods (fishing stocks, the rainforest, the timber)
Non-rivalrous	Club goods (cable television, golf courses, group discounts, Wi-Fi access)	Public goods (the environment, national defense, lighthouses, information)

Rivalrousness and excludability are two standards by which private goods are separated from public goods. Rivalrousness refers to the availability of a good's benefit for users after its consumption. A rivalrous good is something that can only be used by one person at a time and if it is used by one it is not available to others. Excludability refers to a user's ability to prevent someone from accessing or consuming a good. An excludable good is something that upon one's use, both physically and costlessly, prohibits other people from

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Collective Action, (Cambridge, UK: Cambridge University Press, 1990). Adam Smith was the first to make the distinction between public and private goods and justified the provision by the Sovereign of three public goods: national defense; administration of justice and public safety; and maintenance of public works and institutions. See Adam Smith, *The Wealth of Nations*, IV, online: <http://www.econlib.org/library/Smith/smWN.html> (last visited 19 December 2012).

[27] John Black, Nigar Hashimzade, & Gareth Myles, *A Dictionary of Economics*, (Oxford, UK: Oxford University Press, 2009) [A Dictionary of Economics].

[28] *Ibid*.

[29] Van Lindberg, *Intellectual Property and Open Source*, (Sebastopol, CA: O'Reilly, 2008), at 10.

using it. Most private goods, such as apples and houses, are rivalrous and excludable goods. For example, an apple can only be consumed by one person at a time and the physical possession of a house prohibits others from using it. In contrast to private goods, public goods are characterized by non-rivalrousness and non-excludability. Light from a lighthouse is non-rivalrous because more than one ship can enjoy the light at the same time. It is also non-excludable because one's use cannot physically prohibit others from using it.

Information is non-rivalous and possesses the following three distinctive features. First, it can be used by many without becoming depleted. Second, every user gets the identical quality of the usage. Third, the number of users has no impact on either the quality of the usage or the cost of production. In other words, it costs the producer almost nothing to add another user (i.e., the marginal cost of benefiting from the product is little); and the product quality is a constant whether it is used by one or one million. For example, millions of people can read the same digital book in Google Books or watch the same video on YouTube without detracting from one another, or affecting greatly the cost of making the book or the song available in the first place. In short, the non-rivalrous feature of intellectual property allows many people to use the same intellectual property good at the same time with the same quality.

Thomas Jefferson, the third president of the United States, wrote the following in 1813:

> [The] peculiar character [of an idea] is that no one possesses the less, because every other possesses the whole of it. He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me. That ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his conditions, seems to have been peculiarly and benevolently

> designed by nature, when she made them, like fire, expandable over all space, without lessening their density in any point, and like the air in which we breathe, move, and have our physical being, incapable of confinement or exclusive appropriation.[30]

Jefferson's example of an idea, or the metaphor in nature – fire, expanding without lessening density – demonstrates vividly what non-rivalrousness means. It also shows the potentially massive influence that a non-rivalrous good can make without incurring additional costs. Bernard Shaw explained the ever-accumulating enrichment effect of sharing ideas compared with the zero-sum exchange of apples: "If you have an apple and I have an apple and we exchange apples then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas."[31] The ever-accumulating enrichment effect of sharing ideas holds more truth in our networked knowledge economy when "sharing" and "collaborating" has become the norm.

The non-rivalrousness feature of information in consumption presents both opportunities and challenges. On the one hand, it has great potential to be deployed for transferring technology and closing the knowledge gap. On the other hand, the characteristic of non-rivalrousness in consumption makes knowledge and information susceptible to underproduction. Since the marginal cost producers incur is zero, it would be inefficient and undesirable to exclude any consumers from enjoying the benefits.[32] However, there are significant costs associated with producing valuable information as well as costs associated

[30] Letter from Thomas Jefferson to Isaac McPherson, (Aug 13, 1813) in Andrew A. Lipscomb & Albert Ellery Bergh, eds., *The Writings of Thomas Jefferson*, vol. 13, (Washington: Thomas Jefferson Memorial Association, 1905), at 333; also available in The Founders' Constitution, "Thomas Jefferson to Isaac McPherson," vol. 3, art. 1, s. 8, cl. 8, doc. 12, online: The Founders' Constitution <http://press-pubs.uchicago.edu/founders/documents/a1_8_8s12.html> (last visited 31 August 2011).

[31] Bernard Shaw, *The Apple Cart: A Political Extravaganza*, (London, UK: Longmans, 1956).

[32] As Joseph E. Stiglitz puts it, "If information is to be efficiently utilized, it cannot be privately provided because efficiency implies charging a price of zero—the marginal cost of another individual enjoying the knowledge." Joseph E. Stiglitz, "Knowledge as a Global Public Good", in Inge Kaul, Isabelle Grunberg & Marc A. Stern, eds., *Global Public Goods: International Cooperation in the 21st Century*, (New York: Oxford University Press, 1999) at 309.

with the physical media to contain it and the methods to communicate it. Therefore, mainstream economists generally agree that information and other public goods cannot be provided by the private market mechanism and that special arrangements should be made to remedy a market failure for the production of information.[33]

Two common solutions are used by governments to remedy the underproduction of information due to non-rivalrousness: (1) providing direct subsidies; and (2) instituting an intellectual property system. Governments frequently provide direct funding to public universities and research institutions or tax breaks on private Research & Development (R&D) activities to help generate new knowledge. This solution will be explored further in the thesis. This chapter focuses on the second solution. An intellectual property system is the government action to restore the incentives for private parties to create and disclose knowledge by allowing them to recoup the costs of creating knowledge and reap a benefit from their efforts.

In addition to non-rivalrousness, Jefferson's example of air being incapable of exclusive appropriation leads us to the second characteristic of public goods: non-excludability. Intellectual property goods are non-excludable in that it is difficult, without technological restrictions or other regulatory or legal constraints, to exclude anyone from accessing or consuming an intellectual property good once it is made available. In other words, the public goods characteristics of intellectual property allow it to be equally available, both in terms of quantity and quality, at no or a nominal extra cost to every member of a group once it is made known to one member of such group. For example,

[33] Paul A. Samuelson, "The Pure Theory of Public Expenditure", (1954) 36 Review of Economics and Statistics 387–389.

published patent documents have no means to teach the invention to only some people with the intended result that no others learn it. Again, to quote Jefferson:

> "If nature has made any one thing less susceptible than all others of exclusive property, it is the action of the thinking power called an idea, which an individual may exclusively possess as long as he keeps it to himself; but the moment it is divulged, it forces itself into the possession of every one, and the receiver cannot dispossess himself of it."[34]

What challenges does non-excludability bring to information production? Not being able to exclude users from benefits makes information susceptible to free-riding and overuse. Free-riding problem arises when people use public goods without paying due to the government service is offered to everyone without the possibility to exclude anyone. Free-riding is a situation in which one individual benefits from a public good without contributing to its cost.[35] Once the public good is provided, it is not easy to limit its supply only to those who are willing to contribute to the costs of supplying it. Therefore, potential users may wait for others to supply the good and then benefit from the good for free. Garrett Hardin's classic description of the "tragedy of the commons" explains that a commonly held resource will be overused if everyone has access to it, but has no right to exclude others' access.[36]

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[34] Letter from Thomas Jefferson to Isaac McPherson, (Aug 13, 1813) in Andrew A. Lipscomb & Albert Ellery Bergh, eds., *The Writings of Thomas Jefferson*, vol. 13, (Washington: Thomas Jefferson Memorial Association, 1905) at 333; also available in The Founders' Constitution, "Thomas Jefferson to Isaac McPherson," vol. 3, art. 1, s. 8, cl. 8, doc. 12, online: The Founders' Constitution <http://press-pubs.uchicago.edu/founders/documents/a1_8_8s12.html> (last visited 31 December 2009).

[35] *A Dictionary of Economics*, *supra,* note 27 in chapter 2.

[36] Garret Hardin, "The Tragedy of the Commons", (1968) 162:3859 Science 1243, at 1244, reprinted in Robert C. Ellickson, Carol M. Rose & Bruce A. Ackerman, eds., *Perspectives on Property Law*, 3rd ed., (New York: Aspen Law & Business, 2002). In a "tragedy of the anticommons" situation, as Michael Heller first coined in 1998, too many property owners can lead to underuse of resources and frustrate commercial development. See Michael A. Heller, "The Tragedy of the Anticommons: Property in the Transition from Marx to Markets", (1998) 111 Harv. L. Rev. 621. [Heller, "The Tragedy of the Anticommons"] Applying this theory to biomedical research and patent law, Michael Heller and Rebecca Eisenberg argue that the over-proliferation of patents may deter innovation. It is difficult and costly to negotiate licences with all the patent holders in order to bring useful products to the market. See Michael A. Heller & Rebecca S. Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research", (1998) 280 Science 698 [Heller & Eisenberg, "Can Patents Deter Innovation?"]. See also, Caroline A. Crenshaw, "Patents and Patients: Who is the Tragedy of the

> Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.
>
> As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, 'What is the utility to me of adding one more animal to my herd?' This utility has one negative and one positive component.
>
> The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.
>
> The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision-making herdsman is only a fraction of -1.
>
> Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another … But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all."[37]

The root of the "tragedy of the commons" lies in the tendency of human nature to free-ride.[38] Knowledge and information, as a public good, is even more susceptible to the free-

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Anticommons Impacting and Who is Bearing the Cost of High-Priced Biotechnological Research?" (2008) 9(2) Minn. J.L. Sci. & Tech. 913; Michael Heller, *The Gridlock Economy: How Too Much Ownership Wrecks Markets, Stops Innovation, and Costs Lives*, (New York: Basic Books, 2008). [Heller, *The Gridlock Economy*]

[37] *Ibid*.

[38] Kenneth Arrow, "Economic Welfare and the Allocation of Resources for Invention", in National Bureau of Economic Research, ed., *The Rate and Direction of Inventive Activity: Economic and Social Factors*, (New Jersey: Princeton University Press, 1962) at 609-626, online: NBER <http://papers.nber.org/chapters/c2144.pdf?new_window=1> (last visited 19 December 2012) [Arrow, "Economic Welfare and the Allocation of Resources for Invention"]; Kenneth J. Arrow, "The Economics of Information: An Exposition", (1996) 23 Empirica 119-128.

rider problem. Each member of our society makes a cost-benefit analysis which may be reasonable on its own, but in aggregate may ineluctably lead to the loss of resources.[39]

By allowing creators and inventors to profit from their intellectual production and instituting legal sanctions on infringement (e.g., injunction, damages, or even criminal penalties), intellectual property law internalizes negative externalities to discourage overuse and depletion.[40] An externality is a cost or benefit accruing to someone who is not engaged in a certain economic activity. Over-hunting which imposes external costs on subsequent hunters and pollution which imposes clean-up costs on local residents are two typical examples.[41] Private property rights, tax, and regulation are three common ways to incorporate into the market price of the external costs and benefits, such as risk, sustainability, or missed opportunity.[42] According to Harold Demsetz, private property rights are the vehicle by which the maximum internalization of externalities is achieved.[43] Thus, intellectual property rights allow the costs of producing innovative goods to be incorporated into the market price and thus discourage overuse and depletion.

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[39] Yochai Benkler explains: "…every individual with access to the resources internalizes the full benefit of using whatever part of the resource the individual is capable of using, but shares the costs of depletion caused by his or her use with all other potential users of the resource. Similarly, the benefits of an individual's investment in maintenance of the resource are shared with all other potential users, while the costs of such investments are not." See Yochai Benkler, "Overcoming Agoraphobia: Building the Commons of the Digitally Networked Environment," (1998) 11 Harv. J. L. & Tech. 287, at 360 (citations omitted).

[40] Richard Cornes & Todd Sandler, *The Theory of Externalities, Public Goods and Club Goods*, (Cambridge, U.K.: Cambridge University Press, 1986); C. Dahlman, "Knowledge for Development and Knowledge as an International Public Good", Background Paper prepared for the UNIDO Project on Global Public Good for Economic Development, (Vienna: United Nations Industrial Development Organization, 2005); R. Kanbur, T. Sandler, & T. Morrison, *The Future of Development Assistance: Common Pools and International Public Goods*, (Washington, D.C.: Overseas Development Council, 1999).

[41] Harold Demsetz uses over-hunting as an example: "[b]ecause of the lack of control over hunting by others, it is in no person's interest to invest in increasing or maintaining the stock of a game. Overly intensive hunting takes place. Thus a successful hunt is viewed as imposing external costs on subsequent hunters—costs that are not taken into account fully in the determination of the extent of hunting and animal husbandry." Harold Demsetz, "Toward a Theory of Property Rights", (1967) 57 American Economic Review 347 at 351.

[42] Harold Demsetz, "Toward a Theory of Property Rights", (1967) 57 American Economic Review 347 at 350.

[43] *Ibid*., at 356-357.

To sum up, the underproduction problem associated with non-rivalrousness and the free-riding and overuse problems associated with non-excludability are the main reasons why we have an intellectual property system. Public goods cannot be provided through a market mechanism alone. There is a strong rationale for the government to directly or indirectly finance public goods that are of national importance, such as roads, national defense, science base, and public domain knowledge. Government intervention in information markets allows inventors "to control and profit from goods that are costly to produce but which are virtually costless to reproduce or to appropriate once they have been created."[44]

2.2.2 Innovation as an Intrinsic Public Good

Assessed against the characteristics of public goods discussed above, I argue that innovation possesses characteristics of public goods. At the outset, it is useful to clarify what it means for innovation to be a *good*. Narrowly defined, innovation goods refer to products and processes embodying an innovation. More broadly conceived, innovation goods also include "the benefits to society that derive from the provision of certain utilities or the satisfaction of wants,"[45] such as the provision of green energy or sugar-free sweetener for diabetic patients. Furthermore, innovation is a *public* good because it possesses the two criteria of non-rivalrousness and non-excludability. Innovation is non-rival because it can be consumed by many without becoming depleted. It is non-excludable because in principle no one can be prevented from benefiting from an innovation good.

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[44] Dan L. Burk & Mark A. Lemley, "Is Patent Law Technology-Specific?" (2002) 17 Berkeley Tech. L.J. 1155 at 1158.

[45] Pablo Accuosto & Niki Johnson, "Financing the Information Society in the South: A Global Public Goods Perspective", prepared for the Association for Progressive Communications (APC) by the Instituto del Tercer Mundo, Montevideo, Uruguay, June 2004, at 15, available online: <http://gb1.apc.org/es/system/files/financing.pdf>.

It is worth emphasizing that the public good nature of innovation does not mean that it has to be provided by governments or public bodies. In fact, significant corporate research and development (R&D) investment is an important component that stimulates technological innovation and the commercialization of innovation.[46] Rather, it means that the benefits derived from innovation could be potentially available to all, including free-riders who have not paid for producing such innovation.[47] Moreover, it cannot be assumed that everyone derives the same measure of benefit because the potential benefit one derives from innovation also depends on their preferences and capacity to consume.[48]

Due to its public good nature, innovation has the greatest potential to advance the standard of living in less affluent economies and equalize the development divide. In the current subsection I will focus on the welfare-enhancing function of innovation, and in the next subsection I will elaborate on its distributive and equalizing effects.

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[46] For example, the emergence of Japan at the economic forefront owes much to its ability to transform itself into an "IP-based nation" and thus gain and maintain competitive advantage in the 21st knowledge economy. Japan introduced a new basic law on IP and created an inter-ministerial "Strategic Council on IP" directly under the Prime Minister in order to transform Japan into an "IP-based nation". See Ove Granstrand, "Patents and Policies for Innovations and Entrepreneurship" in Toshiko Takenaka, eds., *Patent Law and Theory: A Handbook of Contemporary Research*, (Cheltenham, UK: Edward Elgar, 2009); See also, Hisamitsu Arai, *Intellectual Property Policies for the Twenty-First Century: The Japanese Experience in Wealth Creation*, (Geneva: WIPO Publication No. 834 (E), 2000), online: WIPO <http://www.wipo.int/export/sites/www/freepublications/en/intproperty/834/wipo_pub_834.pdf>; Hisamitsu Arai, "Intellectual Property Revolution: Japan's Experience in Formulating a National IP Strategy", excerpt from *Intellectual Property Revolution* (Tokyo: Kadokawa Publishing, 2006), English translation available online: WIPO <http://www.wipo.int/export/sites/www/academy/en/research/research/pdf/national_ip_strategy.pdf>. See also, Elias G. Carayannis, Dimitris Assimakopoulos & Masayuki Kondo, eds., *Innovation Networks and Knowledge Clusters: Findings and Insights from the US, EU and Japan*, (New York: Palgrave Macmillan, 2008). The authors have found that Japan has embraced the innovation agenda more aggressively than any other nation, with major investments in scientific infrastructure, strong encouragement for corporate research and development, and active support for commercialization of discoveries. According to the World Intellectual Property Organization Statistics, the majority of the approximately 6.1 million patents in force in 2006 worldwide were owned by applicants from Japan. See *World Patent Report: A Statistical Review,* (Geneva: WIPO, 2008) at 8. The Report also indicates that in 2005, the number of patents awarded in Japan surpassed those granted in the US.

[47] Inge Kaul, Isabelle Grunberg & Marc A. Stern, eds., *Global Public Goods: International Cooperation in the 21st Century,* (New York: Oxford University Press, 1999).

[48] *Ibid*.

Innovation creates substantial positive externalities when widely shared and thus can be used as a development asset and welfare-enhancing tool.[49] The cost of diffusing innovation approaches zero marginal cost once the infrastructure is established to put the innovation into the market. Furthermore, the value of innovation increases, rather than being diminished, with wider consumption. In addition, innovation produces higher social returns than private returns. In other words, the benefits of innovation to society as a whole greatly exceed the benefits to the person who first comes up with the innovative idea and the firm that develops the innovative products and processes.[50] These characteristics can be used to nurture and expand the basic science base and technological capacity that are prerequisites to the creation of a functioning future innovation market.

On the other hand, innovation raises the classic public good problems of under-provision, free-riding and overuse. Similar to information and knowledge, innovation is costly to create and can be easily and cheaply reproduced once introduced into the market.[51] From a welfare economics point of view, free sharing of innovation ensures the most efficient use of innovation, but provides no incentive for its production. The problem of under-provision arises because innovators will not likely produce innovations if they cannot

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49 Margaret Chon, "Copyright and Capability for Education: An Approach from Below", in Tzen Wong & Graham Dutfield, eds., *Intellectual Property and Human Development: Current Trends and Future Scenarios*, (Cambridge: Cambridge University Press, 2011), available online: <http://www.piipa.org/index.php?option=com_content&view=article&id=99>. [Chon, "Copyright and Capability for Education"]

50 See Jonathan B. Baker, "Beyond Schumpeter vs. Arrow: How Antitrust Fosters Innovation", American Antitrust Institute Working Paper No. 07-04, available online: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1103623> (last visited August 31, 2012). See also, Edwin Mansfield, "Microeconomics of Technological Innovation", in B. Guile & H. Brooks, *Technology and Global Industry*, (Washington, D.C., National Academy Press, 1987) at 307-326.

51 Kenneth Arrow pointed out that information and knowledge possess characteristics of public goods. See Arrow, "Economic Welfare and the Allocation of Resources for Invention", *supra,* note 38 in chapter 1, at 609-625. Nordhaus noted that knowledge "is expensive to produce, cheap to reproduce, and difficult to profit from" in the absence of government intervention. See William D. Nordhaus, *Invention, Growth and Welfare*, (Boston: MIT Press, 1969) at 70.

appropriate some value from what they produce. The problems of free-riding and overuse arise when it is impossible or prohibitively costly to exclude non-paying users from consuming innovation goods. Without some kind of public action, free-riding often occurs in the innovation market and innovators cannot always appropriate the returns.

Therefore, a legal regime is needed to remedy a failure in the innovation market by providing both the incentive for producing such innovation and the right to access. The common way that governments address innovation market failures is by instituting an intellectual property system to create artificial scarcity. Intellectual property transforms a public good into a private one, thus making exclusion possible in consuming innovation goods. For example, patent rights correct this market failure by allowing inventors to profit and society to benefit from increased innovation. Without patent protection, inventions are prone to be imitated, thereby discouraging inventors from investing in technological advancement and economic progress.

There are three inefficiencies associated with promoting innovation through patent protection. First, some individuals will be priced out of access, reducing overall social welfare. Second, limited diffusion of new technologies may reduce macroeconomic efficiency in ways that reduce benefits to society as a whole. Third, because existing knowledge is also an input into the production of new knowledge, impeding the diffusion of knowledge resources will also tend to diminish innovation over the long term.

A public-private partnership and concerted efforts are needed to address these inefficiencies. Paul Samuelson noted that for public good, normal market mechanisms of price signalling would be inadequate to stimulate optimal provision; rather, organized public

spending promised the most efficient outcomes.[52] The optimal provision of innovation depends on financial investment and policy support provided by the government as well as the private sector. Innovation is a dynamic social process driven by both market mechanisms and government policies that help to create the appropriate institutional structures and incentive mechanisms to build solid science and technology bases, provide lifelong learning opportunities for productivity growth, encourage investment in intellectual infrastructure, and cultivate entrepreneurship culture. Market mechanisms are essential in steering and allocating physical, capital, and human resources in directions that are conducive to generate innovation. However, the market alone is not sufficient. Government policies are critical in the systematic coordination and facilitation of the legal, financial, and institutional framework to foster the generation, transfer, adoption, adaptation, and diffusion of innovation. In addition, taxation, government subsidies, and public investment in basic research, health, education, and intellectual infrastructure provide important incentives to innovate.

2.2.3 The Distributive and Equalizing Effects of Innovation as a Global Public Good

I will argue in this section that innovation is a global public good and has an important role to play in fostering distributive justice and intergenerational equality. Further, there is a normative foundation in fairly distributing innovation resource and opportunity for greater social justice. Distributive justice requires that everyone should have an equal opportunity to obtain innovation resources and cultivate innovation capabilities.

[52] The economic theory of public goods originated in the 1950s when Paul Samuelson articulated his theory of "collective consumption goods." See Paul A. Samuelson, "The Pure Theory of Public Expenditure", (1954) 36 Rev. Econ. & Stat. 387, at 387; Paul A. Samuelson, "Diagrammatic Exposition of a Theory of Public Expenditure", (1955) 37 Rev. Econ. & Stat. 350-356.

Intergenerational equality requires that future generations have equal innovation opportunities for achieving at least the same innovation capability as their predecessors. A challenge facing policy-makers is how to balance the efficiency of an innovation system in generating net social benefits and equality of opportunities to enjoy such benefits.

Nations are more interrelated than ever before: a sovereign nation is more dependent on world peace to secure stability at home, global prosperity to grow national economy, and collective ingenuity to cure local epidemic. The growing international interdependence has globalized many national public goods (e.g., scientific discovery) as well as national problems (e.g., communicable disease) as a result of technological innovation, economic globalization, and multilateral cooperation.[53] The concept of a "global public good" is a geographic extension of the properties of a national public good into a global scope. It is generally defined as a public good whose benefits transcend national boundaries. For example, Kaul, Grunberg, and Stern define global public goods as ones that are "quasi universal in terms of countries (covering more than one group of countries), people (accruing to several, preferably all, population groups), and generations (extending to both current and future generations, or at least meeting the needs of current generation without foreclosing development options for future generations)."[54] High seas, world peace, communicable

[53] David Long & Frances Woolley, "Global Public Goods: Critique of a UN Discourse", (2009) 15 Global Governance 107 at 110.

[54] Inge Kaul, Isabelle Grunberg, & Marc Stern, *Global Public Goods: International Cooperation in the 21st Century*, (New York: Oxford University Press, 1999); Inge Kaul, *et al*., *Providing Global Public Goods: Managing Globalization*, (New York: Oxford University Press, 2003); Clara Brandi, Christine Ladenburger, & Anna Pegels, "Intellectual Property Rights as a Challenge to Providing Global Public Goods", German Development Institute Discussion Paper 17/2010, available online: <http://www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/%28ynDK_contentByKey%29/ANES-8ANHC9/$FILE/DP%2017.2010.pdf>. (last visited August 31, 2012)

disease eradication, and reducing carbon dioxide emissions are often cited as examples of global public goods.[55]

Knowledge, has also been recognized as a global public good.[56] New growth theory highlights the role of increasing returns in economic growth due to the external economies (spillover effects) of knowledge, innovations, and ideas.[57] Stiglitz considers knowledge an important global public good because its spillover effects transcend national boundaries.[58] Further, Stiglitz underlines the need for national governments to sponsor the infrastructure for the creation and dissemination of knowledge goods and the need for international collective action for efficient production and equitable use of global knowledge.[59]

I contend that innovation should be properly considered as a global public good that equalizes the rich and the poor in exploiting their intellect, knowledge, and innovation capability, and distributes costs and benefits in the global innovation commons. Innovation is a global public good because its characteristics of non-rivalrousness and non-excludability can be felt on a global scale. Once innovation has been introduced into one market, due to its

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[55] Anders Hjorth Agerskov, "Global Public Goods and Development: A Guide for Policy Makers", available online: <http://siteresources.worldbank.org/EXTABOUTUS/Resources/PublicGoods.pdf>. (last visited August 31, 2012)

[56] Kenneth J. Arrow recognized knowledge as a public good. See Arrow, "Economic Welfare and the Allocation of Resources for Invention", *supra,* note 38 in chapter 1. Joseph E. Stiglitz discussed in detail knowledge as an international public good. Joseph E. Stiglitz, "Knowledge as a Global Public Good", in Inge Kaul, Isabelle Grunberg & Marc A. Stern, eds., *Global Public Goods: International Cooperation in the 21st Century*, (New York: Oxford University Press, 1999) at 309, available online: <http://cgt.columbia.edu/files/papers/1999_Knowledge_as_Global_Public_Good_stiglitz.pdf> (last visited August 31, 2012).

[57] S. Kosempel, "A Theory of Development and Long Run Growth", (2004) 75 Journal of Development Economics at 201-220.

[58] Stiglitz identifies five public goods of global scale including international economic stability, international security (political stability), the international environment, international humanitarian assistance and knowledge. Joseph E. Stiglitz, "Knowledge as a Global Public Good", in Inge Kaul, Isabelle Grunberg & Marc A. Stern, eds., *Global Public Goods: International Cooperation in the 21st Century*, (New York: Oxford University Press, 1999) at 309, available online: <http://cgt.columbia.edu/files/papers/1999_Knowledge_as_Global_Public_Good_stiglitz.pdf> (last visited August 31, 2012).

[59] *Ibid.*

ability to be consumed by additional users without the benefits to current users being detracted, the marginal cost of another market enjoying the benefits of the new innovation is zero. Take pharmaceutical innovation for example, once a vaccine against HIV is discovered and introduced into one country, it can potentially benefit patients in all countries at a nominal marginal cost. From a welfare-maximization point of view, no country should be excluded from freely accessing the vaccine. In fact, since the marginal cost is zero for any additional user, efficiency requires a price of zero for the use of the vaccine. The dilemma is that if the price were zero for all users, pharmaceutical companies would not have the incentives to provide any innovation.[60] In addition, the non-excludability character of innovation makes innovators unable to exclude free-riders from using the innovation. As a consequence, innovators would not be able to add a premium to the price of their innovative products, to collect licence fees, or to sell the innovation. They would thus be unable to appropriate the value of the benefits of new knowledge to be compensated for the cost of innovating activities.

Therefore, global regimes are required to govern the provision, access to, and dissemination of innovation.[61] One purpose of such global regimes is to generate or enhance positive externalities of innovation and correct negative ones.[62] Possible activities include

[60] Bohumir Pazderka & Klaus Stegemann, "Pharmaceutical Innovation as a Collective Action Problem: An Application of the Economic Theory of Alliances", (2005) 8:2 Journal of World Intellectual Property 157 at 160.
[61] Sabrina Safrin, "Providing Public Goods under International Law: Of Openness and Enclosure", (2010) 104 Am. Soc'y Int'l L. Proc. 148.
[62] Albert Binger, "Global Public Goods and Potential Mechanisms for Financing Availability", Background paper prepared for the Fifth Session of the Committee for Development Policy meeting, April 7-11, 2003, online: <http://www.un.org/esa/policy/devplan/al_binger.pdf>. (last visited August 31, 2012)

investments in knowledge creation, collaborative research, increasing interoperability of technology standards,[63] and coordinated management of cross-border externalities.

2.3 The Dynamics of Innovation Models and Decentralization of Innovation Capability

The perception of the nature of innovation capabilities, processes, and systems has evolved significantly over the last decade. We are moving away from the technological characteristic of innovation to an understanding of innovation as an interactive and cumulative process which has an important role to play in fostering distributive justice and intergenerational equality. Indeed, the concept of innovation encompasses creative forms of business organizations, new modes of institutional collaborations, behavior changes, policy adaptations, social relations, entrepreneurship incentives, and governance reform.[64]

This section first gives a background of the changing innovation environment and discusses four innovation models: open and collaborative innovation, cumulative innovation, user innovation, and indigenous innovation. These innovation models exemplify vividly that innovation is dynamic and cumulative. Innovation is dynamic in the sense that diverse innovation modes coexist in a system of innovation and interact with the broader regulatory regime. Innovation is also cumulative in that most innovative ideas are developed from knowledge in the public domain, which can be regarded as a common innovation resource for all. Importantly, the dynamism of innovation depends on the extent to which public knowledge can be accessed and communicated unrestrictedly.

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[63] Such as the JPEG protocol for photographic compression and the design of key memory chips. See Peter Lee, "The Evolution of Intellectual Infrastructure", (2008) 83 Wash. L. Rev. 39 at 42.

[64] Innovation includes the science and technology related "array of new ideas, institutions, practices, behaviours and social relations that shape scientific and technological patterns, purposes, applications and outcomes." See STEPS Centre, "Innovation, Sustainability, Development: A New Manifesto," (Brighton: STEPS Centre, 2010), available online: <http://anewmanifesto.org/wp-content/uploads/steps-manifesto_small-file.pdf>. (last visited August 31, 2012)

2.3.1 The Changing Innovation Environment: Innovating Wikily

Web 2.0 technologies have changed how we innovate. A fundamental change is happening in the way innovative actors interact with one another, innovative actions are organized, and innovative products are produced and disseminated. The new and networked innovation environment is characterized by the principles of "openness, transparency, decentralized decision-making, and distributed action."[65]

As globalization has decentralized commercial exchanges and social construction, the Internet has decentralized information exchanges and knowledge construction. The Internet was created initially out of a government-funded defence project and then became university-based for collaborative research and communication. Now it is possible to disseminate information and deliver knowledge universally in an affordable and accessible way. In particular, participative Web 2.0 platforms have changed the way we connect to each other and have provided all users with tools to communicate to a global audience.[66] More importantly, these applications have constructively changed the way in which knowledge and innovation are produced and disseminated.

As for the decentralization of knowledge production, Wikipedia, the free online encyclopedia, is an ideal example of how mass intelligence and cloud computing has

[65] Diana Scearce, Gabriel Kasper, & Heather McLeod Grant, "Working Wikily 2.0: Social Change with a Network Mindset", (July 2009), available online: <http://www.monitorinstitute.com/documents/WorkingWikily2.0hires.pdf>. (last visted August 31, 2012).

[66] According to Wikipedia, "Web 2.0 is commonly associated with web development and web design that facilitates interactive information sharing, interoperability, user-centered design and collaboration on the World Wide Web. Examples of Web 2.0 include web-based communities, hosted services, web applications, social-networking sites, video-sharing sites, wikis, blogs, mashups and folksonomies." Online: <http://en.wikipedia.org/wiki/Web_2.0> (last visited 31 December 2009). Examples of the kinds of innovative firms that employ theses new business models include MySpace, YouTube, flickr, Second Life, facebook, twitter, linkedin, dopplr.

changed the way knowledge is created.[67] One author considers Wikipedia "the continuation of the Enlightenment's Encyclopedia project: the idea of a knowledge-based world as a means of social improvement."[68] Another example is Cornell Law School's Wex, a law dictionary and encyclopedia that can be collaboratively created.[69] As for the decentralization of knowledge dissemination, Web 2.0 technologies have infused the public with the power to speak to the mass. The Social Science Research Network (SSRN) and the BePress have become the *de facto* channels of scholarly communication.[70] Wikis also present an important opportunity to share with others and to engage people across institutions, across cultures, and across borders in the deliberative development of knowledge.

The WIPO Director General observed that "the means of production of knowledge was moving from the individual to the collective and from national to international."[71] This

[67] Wikipedia was launched in 2001 by a non-profit organization named "Wikimedia Foundation." According to its own website, it is "a free, web-based, collaborative, multilingual encyclopedia project." It contains 3,057,282 articles on 10 October 2009, which "have been written collaboratively by volunteers around the world, and almost all of its articles can be edited by anyone with access to the site." See online: Wikipedia <http://en.wikipedia.org/wiki/Wikipedia> (last visited 31 August 2012). Beth Simone Noveck observes: "Law students are footnoting the publicly authored, online resource known as Wikipedia in their term papers. Courts have cited to Wikipedia in authoritative judicial opinions. Law professors are doing so in their journal articles." Noveck justifies the use of Wikipedia in legal education: "Wikis enable students to deliberate with others and engage in the public exchange of reasoned ideas and arguments. Working together fosters greater individual learning by making students – and their teachers – active producers of expertise rather than passive consumers of information." See Beth Simone Noveck, "Wikipedia and the Future of Legal Education", (2007) 57 J. Legal Educ. 3 at 4. See also, Matthew Rimmer, "Wikipedia, Collective Authorship, and the Politics of Knowledge" in Arup & Caenegem, *Intellectual Property Policy Reform, supra,* note 4 in chapter 2.

[68] Jeffrey Reid, *Great Philosophers: A Brief Story of the Self and its Worlds*, (Peterborough, ON: Broadview, 2009) at 54.

[69] According to its website: "Wex is an ambitious effort to construct a collaboratively-created, public-access law dictionary and encyclopedia." Online: <http://topics.law.cornell.edu/wex> (last visited 19 December 2012).

[70] According to its website, "Social Science Research Network (SSRN) is devoted to the rapid worldwide dissemination of social science research and is composed of a number of specialized research networks in each of the social science." Online: SSRN <www.ssrn.com>. SelectedWorks is an open access publication tool provided by the Berkeley Electronic Press, online: <http://works.bepress.com/> (last visited 19 December 2012).

[71] WIPO, "WIPO Director General Highlights Importance of Intellectual Property for Innovation and Technology Transfer", PR/2010/640, (May 10, 2010), online WIPO <http://www.wipo.int/pressroom/en/articles/2010/article_0013.html>.

phenomenon is captured in Eric von Hippel's description of "user-centred innovation"[72] and Yochai Benkler's account of "commons-based peer production." [73] In a networked information economy characterized by a radical decentralization of physical, capital, and human capabilities,[74] innovation is driven by "decentralized peer-production rather than hierarchically-assigned actions."[75] The emerging modes of innovation have departed from the traditional concept of single-inventor and embraced team-based, cumulative, and open and collaborative modes of innovation. The dynamics of the innovation paradigm offers developing countries great potential and alternatives to profit from indigenous innovation.

For the purpose of this discussion, I divide innovation systems into two sub-categories according to the nature of the incentives they provide. The first sub-category relies on the prospect of proprietary protection to incentivize innovation, best epitomized by the patent system. The second sub-category is composed of non-proprietary systems that rely on incentives from government support, commons and open source systems to innovate. In this context "commons" refers to the system of knowledge (1) either in the public domain; (2) or for which the term of proprietary protection has elapsed; (3) or knowledge for which proprietary protection is, or was, deliberately not sought (e.g., the Human Genome Project).

Mainstream economists generally assume that without patent protection there would not be enough incentives for innovation and therefore society would suffer from lack of

[72] Eric von Hippel, *Democratizing Innovation, supra,* note 17 in chapter 1, at 1.
[73] Yochai Benkler, *The Wealth of Networks, supra,* note 15 in chapter 1, at 60.
[74] "The critical characteristic of the networked economy is a radical decentralization of physical capital necessary for the production, storage, distribution, and processing of information, knowledge, and culture. This decentralization has caused a radical distribution of the practical capability to act in these areas, creating new levels of efficacy for individuals, who increasingly shift from being consumers to being users and producers." See Yochai Benkler, "The University in the Networked Economy & Society", *supra,* note 16 in chapter 1, at 60.
[75] Jeremy de Beer, "Legal Strategies to Profit from Peer Production" (2008) 46 Can. Bus. L. J. 269; and Jeremy de Beer, "Copyright and Innovation in the Networked Information Economy", online: SSRN <http://ssrn.com/abstract=1410158> at 3.

knowledge production. In fact, the TRIPS regime presumes that innovation promotion is contingent on adequate levels of patent protection. I argue that innovation is not motivated only through patent rights and that innovation does occur outside government-protected monopoly regimes. The patent system is an important, but not the only, constitutive component of an optimal innovation environment. Non-proprietary innovation systems may be a more desirable choice over the patent system to incentivize innovation in certain circumstances. There are advantages and disadvantages of choosing one innovation promotion system over another. Innovation produced under patent laws may incur high social costs and only serve the needs of those who can afford monopoly prices. Therefore, important social goals such as providing lifesaving drugs for the poor cannot be achieved by the current patent system alone. Further, not all innovation promotion systems are available in all circumstances. Local needs and markets may be better served by incremental, cumulative and informal innovations than innovations brought by multinationals. In addition, patent law's vision of exclusive, privilege-based, proprietary promotion of innovation does not accommodate the Internet's values of "communality, universalism, disinterestedness, organized skepticism, and independence,"[76] nor does it fit in with user and collaborative innovation.[77]

However, this is not to suggest that the open and user innovation models should supplant the patent system entirely. Rather, using the open and user innovation models is a voluntary decision. The emerging innovation models and the patent system are not mutually

[76] Dan L. Burk, "Cyberlaw and the Norms of Science", (1999) B.C. Intell. Prop. & Tech. F., online: Boston College <http://www.bc.edu/bc_org/avp/law/st_org/iptf/commentary/content/1999060502.html> (last visited August 30, 2012).

[77] Katherine Strandburg observes: "[t]he increasing potential for user innovation, and open and collaborative innovation has brought an explosion of innovative activity that does not fit into the sales-oriented, mass market model which underlies the global intellectual property regime." See *supra,* note 29 in chapter 1.

exclusive, as participating companies can donate their patents to an independent organization, put them in a common pool or grant unlimited licence use to anybody.[78]

2.3.2 The Open and Collaborative Innovation Model

Innovation is an *interactive* process comprised of formal and informal exchanges of information across networks. The Internet has radically lowered the barriers for innovative actors to work collaboratively and enabled greater participation of democratically-engaged citizenry in the knowledge society. It has also generated new opportunities to share knowledge and mobilize innovation resources. In addition, social media applications have facilitated interactive learning and collaborative research by making available more information to more people and allowing them to freely build on others' ideas.

Mary-Anne Williams observes that innovation has evolved from "an activity based on building competitive advantage *within* a single organization to leveraging off collaborative advantage in a rich *ecosystem* which can include business partners, customers, prosumers, consultants, competitors, professional associations, trade bodies, and academia."[79] This phenomenon was coined by Henry Chesbrough as "open innovation". Henry Chesbrough described "open innovation" as the flow of knowledge across corporation boundaries and market expansion for external use of innovation.[80] In a recent publication, Chesbrough defines open innovation as "the use of purposive inflows and outflows of

[78] Erika Kraemer-Mbula & Watu Wamae, eds., *Innovation and the Development Agenda*, (OECD/IDRC, 2010).
[79] Mary-Anne Williams, "Intellectual Property Rights and Collaborative Innovation," paper presented at the 6-7 August 2009 Intellectual Property Scholars Conference, Cardozo School of Law, New York, abstract online: IPSC <http://www.ipscholars.org/> (last visited August 31 2012) (emphasis added). The Innovation and Enterprise Research Laboratory online <http://www.innovation.it.uts.edu.au> (last visited August 31 2012). Prosumers means producer-consumer, a term coined by Alvin Toffler. See Alvin Toffler, *The Third Wave*, (New York: Morrow, 1980).
[80] Henry Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology*, (Boston, MA: Harvard Business School Press, 2003) at 1. [Chesbrough, *Open Innovation*]

knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology."[81] Therefore, open innovation aims to develop new technologies through the combination of internal and external (1) ideas and (2) paths to market.

The open innovation model has two distinctive characteristics that set it apart from the conventional intellectual property-based production model: shared ownership and collaborative methods of production. First, intellectual property rights to patentable inventions are publicly owned and deposited in the public domain. For the non-patentable or sub-patentable ideas, the open innovation model could also support public disclosure of ideas that wouldn't be patentable but where the information might not be in the public domain. As Chesbrough observes, the startling aspect of the open innovation model is that "people cooperate in the absence of direct pay and property right claims."[82] There have been extensive discussions on the economic paradox of why people collaborate and contribute to a public good in the absence of obvious self-interests and proprietary incentives. Supporters of open and collaborative innovation argue that inventors will produce inventions without being assured that they can appropriate all the value that the invention produces.[83] Chesbrough offers both intrinsic and extrinsic motivations to explain people's "altruistic" behaviors: "An intrinsic reward is the satisfaction of 'helping out' as a form of gift-giving. In this view,

[81] Henry Chesbrough, "Open Innovation: A New Paradigm for Understanding Industrial Innovation", in Henry Chesbrough, Wim Vanhaverbeke, & Joel West, eds., *Open Innovation: Researching a New Paradigm*, (Oxford, UK: Oxford University Press, 2006) at 2.
[82] Chesbrough, *Open Innovation, supra,* note 80 in chapter 2.
[83] See Brett M. Frischmann, "An Economic Theory of Infrastructure and Commons Management," (2005) 89 Minn. L. Rev. 917, at 947.

people are altruistic because they share membership in communities that sustain reciprocity and identity. Extrinsic rewards would be the positive effect of a contribution on the reputation of a programmer, thus signaling his or her merit in a competitive job market."[84]

The second characteristic of open innovation is that it builds on a production model that relies on distributed and dispersed capabilities for identifying and implementing innovations. The open innovation model exploits the distributed intelligence of the mass population and encourages inclusive participation in the global knowledge economy.[85] The fact that open source functions in a distributed environment presents an opportunity for developing countries to participate in frontier innovation.[86]

Applying Oliver Williamson's transaction cost economics framework,[87] excessive patent protection and litigation leads to overprotection and inefficient promotion of innovation. On the other hand, under open innovation, firms use markets to supplement internal hierarchies as mechanisms for both sourcing and commercializing innovations, and thereby acquiring the benefits of competition and diversification of risk over the fully vertically-integrated approach.[88]

Open innovation can facilitate accelerated organizational learning and access to new markets – all while reducing the costs of product dissemination and service delivery. An emerging open innovation paradigm enables innovators to collaborate across boundaries,

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[84] *Ibid*.
[85] Bruce Kogut & Anca Metiu, "Open-Source Software Development and Distributed Innovation" (2001) 17 Oxford Review of Economic Policy 248 at 248.
[86] *Ibid*.
[87] Oliver E. Williamson, *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, (New York: Free Press, 1985) at 15-42.
[88] OECD, *Open Innovation in Global Networks*, (Paris: OECD, 2008), online: OECD <http://www.oecd.org/dataoecd/22/44/41446671.pdf>. (last visited August 31, 2012)

reduces transaction costs, and provides a potentially more efficient mode of innovation and knowledge production than an IP-based mode. Conversely, we need to develop complementary institutions to promote open innovation and integrate open innovation into a multi-faceted innovation system. The two most important initiatives are: (1) to provide public financing of R&D and related innovation infrastructure, and (2) to protect collaborators from exploitation and assure that they secure credit for their work.[89] There should be some form of protection against another inventor seeking patentability for an invention that might interfere with the ability to exploit the information in the public domain.

2.3.3 The Cumulative Innovation Model

Innovation is also a *cumulative* and *sequential* process with learning and imitation as a starting point or an important component of many innovation strategies. The process of learning, discovering, and innovating is interactive and dynamic by nature.[90] Radical breakthrough discoveries are rare, and most innovations occur by incrementally improving the existing products, processes, organizations, and relationships.[91] In this respect, innovation is more in terms of recombination of existing knowledge or the application of existing knowledge in a new or different context. Suzanne Scotchmer observes that constant incremental improvements and sequential advancements drive technological progress, and

[89] Rochelle Dreyfuss, "Evaluating the Public Impact of Open Innovation", paper presented at the Intellectual Property Research Institute of Australia Conference of the Applied Econometrics Association, online, <http://www.ipria.org/events/conf/PRI%20Conference/Conference%20Presentations/Rochelle%20Dreyfuss.pdf>.

[90] Ofer Tur-Sinai, "Cumulative Innovation in Patent Law: Making Sense of Incentives" <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1477846> (last visited August 31, 2012).

[91] Graham M. Dutfield & Uma Suthersanen, "The Innovation Dilemma: Intellectual Property and the Historical Legacy of Cumulative Creativity", (2004) 4 I.P.Q. 379-421.

therefore promoting cumulative innovation is imperative.[92] Rochelle Cooper Dreyfuss notes: "Knowledge production is a cumulative enterprise; the storehouse of information does not grow unless creators have the freedom to learn from, and build on, earlier work."[93] Greenstein observes that the emerging digital technologies in the computing and Internet sector are highly cumulative and interactive, requiring a great deal of interoperability between components made by different firms, which has increased the importance of standards, collaboration among firms, and network effects in adoption.[94] Joel West writes: "A fundamental concern of cumulative innovation is that an excessively broad grant of IP rights will shut down cumulative innovation because a second innovator building on the efforts of the first will lack the incentive to develop the necessary extensions and improvements."[95]

Just as scientific discovery and research progresses on a cumulative and non-linear basis, a patented product is not always the final consumer end product.[96] Patent monopolies tend to restrict access to scientific knowledge, hinder the pace of information flows, and

[92] Suzanne Scotchmer, *Innovation and Incentives*, (Cambridge, MA: MIT Press, 2004); See also, Nancy Gallini & Suzanne Scotchmer, "Intellectual Property: When Is It the Best Incentive System?" in Adam B. Jaffe, Josh Lerner & Scott Stern, eds., *Innovation Policy and the Economy*, (Cambridge, MA: MIT Press, 2001) 51 at 65-69; Fiona Murray & Siobhan O'Mahony, "Exploring the Foundations of Cumulative Innovation: Implications for Organization Science", (2007) 18 Org. Sci. 1006.

[93] Rochelle Cooper Dreyfuss, "TRIPS-Round II: Should Users Strike Back?" (2004) 71 U. Chi. L. Rev. 21 at 22.

[94] Network effects mean "the phenomenon whereby a service grows in value as more people use it. For example, services that operate over networks such as e-mail, text messaging, Facebook, and mobile communication rise in value the more people are connected users. This phenomenon is spread early in the growth period through word of mouth, and then later the market expands exponentially as the consumer believes that 'everyone' is linked to the network." See Charles Doyle, "network effect," *A Dictionary of Marketing*, Oxford University Press Inc. Oxford Reference Online. Oxford University Press. University of Ottawa. (accessed 16 June 2012) <http://www.oxfordreference.com/views/ENTRY.html?subview=Main&entry=t325.e1200>. See also, Shane Greenstein, "Innovative Conduct in U.S. Computing and Internet Markets" in Bronwyn H. Hall & Nathan Rosenberg, eds., *Handbook of the Economics of Innovation*, vol. 1, (Elsevier, 2010).

[95] Joel West, "Policy Challenges of Open, Cumulative, and User Innovation", (2009) 30 Wash. U. J. L. & Pol'y 17 at 26, citing Suzanne Scotchmer, "Standing on the Shoulders of Giants: Cumulative Research and the Patent Law", (1991) 5 J. Econ. Persp. 29 at 32.

[96] Clarisa Long, "Patents and Cumulative Innovation", (2000) 2 Wash. U. J. L. & Pol'y 229.

deter the diffusion of innovation.[97] Consider the examples of patent thickets and patent trolls. James Bessen and Eric Maskin specify that when innovation is sequential and complementary, as in the case of software, semiconductors and computers, patent protection can interfere with competition and innovation by enclosing vital pieces of information under the monopolistic control.[98] Therefore, overly broad and stringent patent rights may, to some extent, impede the opportunity to access the existing knowledge.[99]

Reichman stresses the dependence of innovation "on the continued upstream availability of knowledge as both a domestic and a global public good."[100] Patent protection and the profits it generates are only the means to an end, i.e., stimulating innovation. Patent protection is a trade-off between current costs and future gains. Arrow postulates a trade-off between perfect competition and patent protection from competition. In the short-run, patent protection raises prices from competitive levels and thus misallocates society's resources. But in the long-run those higher prices create the very incentives needed for more invention and, with it, the technological progress and economic growth that benefit society most. Put in a different context, excessively broad patent rights increase the short-term, deadweight welfare loss from above marginal cost pricing, with the potential to retard the subsequent use of that information by others who seek to create their own innovations.[101]

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[97] Ted O'Donoghue, "A Patentability Requirement for Sequential Innovation", (1998) 29:4 RAND J. Econ. 654-679.

[98] James Bessen & Eric Maskin, "Sequential Innovation, Patents and Imitation", (January 2000) MIT Department of Economics Working Paper 00-01, online: <http://www.researchoninnovation.org/patent.pdf>.

[99] See P. David & D. Foray, "An Introduction to Economy of the Knowledge Society", (2002) 54 Int'l Social Science J. 9-23. See also, Luc Soete, "Globalisation and the Knowledge-Based Society: Where does Europe Stand in Comparison to Other Regional Areas", UNU-CRIS Occasional Papers, 0-2006/15, online: <http://www.cris.unu.edu/fileadmin/workingpapers/20060705115247.O-2006-15.pdf>.

[100] Jerome H. Reichman, "Nurturing a Transnational System of Innovation", (2007) 16 J. Transnat'l L. & Pol'y 143 at 151.

[101] Rochelle Cooper Dreyfuss, "Are Business Method Patents Bad for Business?" (2000) 16 Santa Clara Computer & High Tech. L.J. 263 at 275.

As a public good, innovation has the potential to raise the productive capabilities of all economic agents and exponentially expand systems efficiency.[102] Therefore, in light of the public good and cumulative nature of innovation, it is important to develop "norms that reinforce the natural sharing ethos of public science and that expand the semi-commons of non-patentable or sub-patentable ideas and know-how accessible to routine engineers."[103]

2.3.4 The User Innovation Model

The digital revolution brought by the Internet and other communication technologies has provided a platform of user and firm collaboration.[104] This has profound implications for innovation networks[105] and the functioning of the patent system.[106] In addition, the Internet and other communication technologies provide a platform for user innovation.[107] The user innovation paradigm developed by Eric von Hippel focuses on the role of users—both individual consumers and firms—in improving products and originating innovation.[108] In the three sources of innovations in a market economy (i.e., users, suppliers, and manufacturers of the product), Eric von Hippel finds that most innovations in the U.S. economy originate with the users of the product and that most industries have innovations dominated by users

[102] *Supra,* note 11 in chapter 2.
[103] *Supra,* note 100 in chapter 2, at 161.
[104] Eric von Hippel, "Open User Innovation" in Bronwyn H. Hall & Nathan Rosenberg, eds., *Handbook of the Economics of Innovation*, vol. 1, (Elsevier, 2010); and Woody Powell & Eric Gianella, "Collective Invention and Invention Networks" in Bronwyn H. Hall & Nathan Rosenberg, eds., *Handbook of the Economics of Innovation*, vol. 1, (Elsevier, 2010).
[105] Woody Powell & Eric Gianella, "Collective Invention and Invention Networks" in Bronwyn H. Hall & Nathan Rosenberg, eds., *Handbook of the Economics of Innovation*, vol. 1 (Elsevier, 2010).
[106] Katherine E. Rockett, "Property Rights and Invention" in Bronwyn H. Hall & Nathan Rosenberg, eds., *Handbook of the Economics of Innovation*, vol. 1 (Elsevier, 2010).
[107] The Internet's "disruptive impact" on innovation has been analyzed by Clayton Christensen. See Clayton M. Christensen, "Disruptive Technologies: Catching the Wave", (January 1995) Harvard Business Review, 43-53; Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, (Boston, MA: Harvard Business School Press, 1997); Clayton M. Christensen & Michael E. Raynor, *The Innovator's Solution: Creating and Sustaining Successful Growth*, (Boston, MA: Harvard Business School Press, 2003).
[108] Eric von Hippel, *The Sources of Innovation*, (New York: Oxford University Press, 1988) at 25-26.

of the product.[109] For example, users were the developers of most of the major innovations in semiconductor processing.[110] These users and consumers can influence the design of the products and processes and contribute significantly to each stage of the innovation.[111] In a sense, the emergence of the user innovation model marks a normative change and paradigm shift to recognize the central position of end-users' participation and collaboration in a dynamic innovation process.

User innovation of both patentable and non-patentable inventions is particularly important to developing countries because their needs are less likely to be addressed in mass markets.[112] Katherine Strandburg explains: "User innovation thus may be an important means of adapting mass-market technologies to the specific needs of citizens of developing countries. User innovation building upon a primary technology is also more likely to be within the capacity of some developing country innovators who may lack sophisticated engineering training and skills, but be able to exploit their own local knowledge and expertise in their innovative activities."[113]

Digital technologies and participatory Web 2.0 communication networks have greatly increased the ability of end-users to collaborate effectively in knowledge production and information exchanges. The user innovation model opens up opportunities for intellectual engagement and debate without being dictated by conventional intellectual

[109] "[U]sers are the first to develop many and perhaps most new industrial and consumer products." See Eric von Hippel, *Democratizing Innovation*, *supra,* note 17 in chapter 1, at 2. See also, Bruce A. McDaniel, *Entrepreneurship and Innovation: An Economic Approach*, (New York: M.E. Sharpe, 2002) at 213-214.
[110] Eric von Hippel, "The Dominant Role of the User in Semiconductor and Electronic Subassembly Process Innovation", (1977) IEEE Transactions on Engineering Management EM-24, no. 2 (May) at 60-71.
[111] OECD, *Measuring Innovation: A New Perspective*, (Paris: OECD, 2010), online: <http://www.oecd.org/dataoecd/51/28/45326349.pdf>. (last visited August 30, 2012)
[112] Katherine J. Strandburg, "Accommodating User Innovation in the International Intellectual Property Regime: A Global Administrative Law Approach", (2009) Acta Juridica 283.
[113] *Ibid*.

property restrictions, market incentives, and organizational boundaries.[114] Harnessing the power of the mass to act upon their intelligence collectively is critical to a well-performing innovation system. To achieve this goal, patent law and innovation strategy need to be more flexible and accommodating.

2.3.5 Indigenous Innovation

By "indigenous innovation", I mean the biological, ecological, medicinal, and agricultural knowledge associated with genetic resources as well as innovative practices and techniques held in common by a community of indigenous people. Such innovation is usually inherited from past generations and gradually improved through collective ingenuity and informal innovation. It is important to distinguish indigenous innovation from home grown innovation and other informal innovation that characterize much of the innovation systems in developing countries. While indigenous innovation may constitute, and share certain characteristics with, part of developing countries' innovation landscapes, it focuses on principles and traditional knowledge concerning plants and plant varieties. Indigenous innovation is the communitarian and cumulative innovation led by indigenous people and informed by their perspectives of the nature world. Indigenous innovation processes and knowledge systems are based on sets of relationships between people and their surrounding biogenetic environment.

[114] Yochai Benkler, "Coase's Penguin, or Linux and the Nature of the Firm," (2002) 112 Yale L. J. 369, online: The Yale Law Journal <http://www.yalelawjournal.org/images/pdfs/354.pdf>. (last visited 19 December 2012) See also, Yochai Benkler, "Sharing Nicely: On Sharable Goods and the Emergence of Sharing as a Modality of Economic Production" (2004) 114 Yale L. J. 273, online: The Yale Law Journal <http://www.yalelawjournal.org/images/pdfs/407.pdf>. (last visited 19 December 2012)

The way in which knowledge system is regulated and innovation model is recognized and rewarded does not favour indigenous innovation.[115] Indigenous and community-based innovation systems have not been recognized and valued in proportion to their contribution to genetic diversity and the quality of the germplasm.[116] Indigenous innovation also has difficulty obtaining protection under the current intellectual property system. This is because "the innovators themselves have been invisible, the forms of transmission of knowledge incomprehensible, and the purpose of the work has differed from that of much formal science."[117] There is obviously a mismatch between indigenous innovation and the main modalities of the patent system.[118] Indigenous innovation is usually the result of community-based collaborative innovation and not protectable under the current patent system. Innovation developed by indigenous groups has been managed by communities for generations, while patent privileges are granted to (an) identifiable inventor(s) based on written disclosure of knowledge of industrial applicability. Therefore, other forms of protection such as undisclosed information and utility models might be of greater relevance for the protection of indigenous innovation.

Recognizing indigenous innovation is important to alleviate economic inequality and promote inclusive growth in developing countries. On the one hand, the kinds of innovations that are needed most for development can only be produced by local innovators. This is partially because incumbent innovators do not have sufficient incentives to invest in innovations whose applicability and commercial viability are limited in small markets. On

[115] Anil K. Gupta, "Innovations for the Poor by the Poor", (2012) 5(1/2) International Journal of Technological Learning at 28-39.
[116] Naomi Roht-Arriaza, "Of Seeds and Shamans: The Appropriation of the Scientific and Technical Knowledge of Indigenous and Local Communities", (1996) 17 Mich. J. Int'l L. 919 at 931.
[117] *Ibid*.
[118] See generally, Peter Drahos & Suzy Frankel, eds., *Indigenous Peoples' Innovation: Intellectual Property Pathways to Development*, (Canberra, Australia: ANU E Press, 2012).

the other hand, locally-originated innovations are particularly valuable because local innovators better understand the nature of the problems to be solved by innovations, as well as enjoy advantages in finding available resources including human resources and networks. We need to recognize indigenous innovation in ways that ensure just rewards for traditional ingenuity while safeguarding the commercial interests of industrial partners. We should also widely disseminate the benefits of indigenous innovation through the global expansion of indigenous entrepreneurship.

2.4 A Multi-faceted System of Innovation

Many questions come to mind when one explores innovation from a system approach. What is the relationship between different innovative actors? How do national and global innovation systems interact and shape the direction and mode of innovation worldwide? How do innovation networks translate human and capital investment to measurable increase in innovation benefits? How might innovation contribute to ameliorate poverty and inequality in a global knowledge economy? To answer these complex questions, we need to adopt an innovation system approach to study the networks of actors involved in the creation and diffusion of innovation as well as the underlying institutions.

The innovation system approach has been widely applied at the local, regional, sectoral, national, and international levels. Generally, an innovation system approach emphasizes the interactions between different innovative actors, e.g., large multinational corporations, small to medium-sized enterprises, and independent inventors.[119] It also

[119] Niosi *et al*. posit: "A national system of innovation is the system of interacting private and public firms (either large or small), universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, in as much as the goal of the interaction is the development, protection, financing or regulation of

focuses on the role of institutions in shaping the flows of knowledge and organizing innovative activities.[120]

The national institutional infrastructure that promotes the efficient use and diffusion of knowledge and the flourishing of entrepreneurship is commonly referred to as the National Innovation System (NIS).[121] Innovation systems, in a broad sense, encompass knowledge clusters and networks of innovators, public education and training to build human capital and innovation capabilities, institutions (including both organizations and the rules governing innovation activities), and capital supplies that affect technological, organizational and social learning needed to solve specific problems.[122] These components work together to enable or restrain the overall environment for the generation, appropriation, application, commercialization, and dissemination of innovation.[123]

The innovation systems theory is inspired by established strands of theories including systems theory, institutional economics, and innovation theories, particularly theories of interactive learning and evolutionary economics. Freeman, Nelson, and Lundvall are among the first scholars who introduced the concept of NIS in the 1980s. The concept of NIS was

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new science and technology." See J. Niosi, et al., "National Systems of Innovations: In Search of a Workable Concept", (1993) 15 Technology in Society, 207-227. Similarly, the OECD defines innovation system as: "the set of organizations (firms, universities, public laboratories, etc.) and their linkages through which innovation processes develop." See OECD, *Managing Innovation Systems*, (Paris: OECD, 2000).

[120] P. Patel & K. Pavitt, "The Nature and Economic Importance of National Innovation Systems", STI Review, No. 14, (Paris: OECD, 1994).

[121] Metcalfe defines national innovation system as: "[t]hat set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies." See J.S. Metcalfe, "The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspective", in P. Stoneman, ed., *Handbook of Industrial Innovation*, (London: Blackwell, 1995).

[122] Bengt-Åke Lundvall, et al., *Handbook on Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Context,* (Cheltenham, UK: Edward Elgar, 2009).

[123] Richard R. Nelson, ed., *National Systems of Innovation: A Comparative Study*, (Oxford: Oxford University Press, 1993).

first defined by Christopher Freeman as "the network of institutions in the public and private sectors whose activities and interactions initiate, import, and diffuse new technologies."[124] A NIS approach to industrial and innovation policy-making was popularized by the works of Richard Nelson and B.-A. Lundvall.[125] Nelson writes: "Innovation systems denote the network of economic and non-economic actors, and the linkages amongst these actors enable technological, organizational and social learning of the kind needed to devise context-specific solutions."[126] In a recent publication, Lundvall defines NIS as follows: "The national innovation system is an open, evolving and complex system that encompasses relationships within and between organizations, institutions and socioeconomic structures which determine the rate and direction of innovation and competence-building emanating from processes of science-based and experience-based learning."[127]

Lundvall makes a distinction between a narrow and broad definition of a system of innovation. A narrow perspective of innovation system equals innovation to science and technology, while a broader one encompasses learning, innovation and competence-building

[124] Christopher Freeman, *Technology Policy and Economic Performance: Lessons from Japan*, (London: Pinter, 1987) at 1.
[125] Richard R. Nelson, "National Systems of Innovation: Preface," in G. Dosi *et al*., eds., *Technical Change and Economic Theory,* (London: Pinter, 1988); Richard Nelson, *The Sources of Economic Growth,* (Cambridge, MA: Harvard University Press, 1996); Richard Nelson, *et al*., *Ivory Tower and Industrial Innovation: University-Industry Technology Transfer before and after the Bayh-Dole Act in the United States,* (Stanford University Press, 2004); Richard Nelson, *et al*., *A Program of Study of the Processes involved in Technological and Economic Catch up* (The Earth institute/Columbia University, 2005).
[126] Richard R. Nelson, "National Systems of Innovation: Preface," in G. Dosi, *et al*., eds., *Technical Change and Economic Theory*, (London: Pinter, 1988). Nelson and Rosenberg define innovation systems as: "The set of institutions whose interactions determine the innovative performance of national firms." See Richard Nelson & N. Rosenberg, "Technical Innovation and Innovation Systems," in Richard R. Nelson, ed., *National Systems of Innovation: A Comparative Study*, (Oxford: Oxford University Press, 1993) at 3-21.
[127] Bengt-Åke Lundvall, et al., *Handbook on Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Context*, (Cheltenham, UK: Edward Elgar, 2009) at 6. This definition is largely consistent with his previous definition of NIS as "The elements and relationships which interact in the production, diffusion and use of new, and economically useful knowledge … and are either located within or rooted inside the borders of a nation state." See B.-A. Lundvall, ed., *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, (London: Pinter, 1992) at 2.

at different levels of aggregation.[128] Lundvall's narrow definition would include "organizations and institutions involved in searching and exploring—such as R&D departments, technological institutes and universities."[129] The broader approach takes into account social institutions, macroeconomic regulation, financial systems, education and communication infrastructures and market conditions as far as these have impact on the learning and competence-building process.[130] Lundvall's broader definition would include "all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring—the production system, the marketing system and the system of finance present themselves as sub-systems in which learning takes place."[131]

According to the above discussion, an effective innovation system should include more than a national innovation strategy and industrial policy. It requires the establishment of innovation institutions and supportive socio-economic infrastructure that are specifically designed to suit the conditions of the country in which it operates. A good innovation system should be specific to the local historical, political, social, cultural, and economic environment and exhibit distinctive characteristics in different economic sectors, technology fields, institutional structures, regulatory frameworks, and national conditions.[132] Further, it

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[128] B.-A. Lundvall, ed., "Innovation System Research: Where it Came from and where it might go", Globelics Working Paper, No. 2007-01, available online: <www.globelics.org>.

[129] Bengt-Åke Lundvall, *et al*., *Handbook on Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Context*, (Cheltenham, UK: Edward Elgar, 2009).

[130] S. Gu & B.-A. Lundvall, "Policy Learning as a Key Process in the Transformation of the Chinese Innovation Systems," in B.-A. Lundvall, P. Intarakurmend, & J. Vang, eds., *Asian Innovation Systems in Transition*, (Cheltenham, UK: Edward Elgar, 2006).

[131] Lundvall, *et al., supra,* note 126.

[132] Edquist identified nine core characteristics of systems of innovation approaches: "innovation and learning; their holistic and interdisciplinary nature; the natural inclusion of a historical perspective; differences between systems and non-optimality; their emphasis on interdependence and non-linearity; the incorporation of product technologies and organizational innovations; the central role of institutions in the systems of innovation approach; their conceptually diffuse nature; and the focus of the systems of innovation literature on conceptual constructs rather than on a more deeply rooted theoretical framework." See C. Edquist, ed., *Systems of Innovation: Technologies, Institutions and Organizations*, (London: Pinter, 1997) at 16-29.

requires building innovation capability and putting in place the necessary "framework conditions" such as human capital, healthy market competition, openness to international trade and capital flows, good corporate governance, intellectual property protection, a reliable financial system to support R&D, supportive tax regulations, entrepreneurial culture, interactive learning opportunities and capabilities to adapt and absorb technology.

Moreover, in an effective innovation system, there should be wide involvement and intense interaction of key innovation stakeholders in the decision-making process. A well-designed national innovation system ensures effective communication and collaboration among entities engaged in innovative efforts, such as universities, public research institutions and private enterprises, and more efficient use of new and existing knowledge and technology throughout the whole economy. In addition, an innovation system needs good governance to steer innovation and coordinate regulatory actions across a wide range of public and private sectors.

I will focus on four components of an institutional framework, namely the national institutions engaged in (1) education and training; (2) market and business environment regulation; (3) physical and informational infrastructure building; and (4) regulatory regime and governance.

The first component is related to educational attainment and skills training. An educated and skillful population that can create and use knowledge is the most decisive predictor of the effectiveness of an innovation infrastructure. Governments should increase the quantity of education by maximizing enrollment rates and should increase the quality of education by creating alternative and continuing education opportunities to increase people's

technological literacy and entrepreneurial skills. However, the education and training component goes beyond the formal education and training institutions and includes more broadly the infrastructural and organizational underpinnings of learning opportunities, including public funding for learning infrastructure, government investment in human capital and R&D, network building and engagement in the world science community through exchange and collaboration, and immigration policy to attract talents.

The second component is related to an effective market mechanism and economic regime, particularly an open trade and business environment. Firms and entrepreneurs need a stable macroeconomic environment and investment climate to undertake innovative efforts. Economic policies of particular relevance are those related to industry and entrepreneurship, tax, trade and investment, competition, and consumer protection. All these policies are important to the adoption and adaptation of existing technologies and the creation of new knowledge.

The third component is related to transportation, communication, and information infrastructure. It should be governments' priority to provide channeling infrastructure as a basis for establishing effective communication and information exchange as well as acquiring and disseminating other technologies.

The fourth component is related to public institution and governance. An effective governance system allows innovators to interact effectively to create and diffuse technologies using the growing stock of domestic and global knowledge. A fuctional legal and institutional infrastructure that ensures effective enforcement of contracts and property

rights, the rule of law, and modest regulatory or financial burdens or transaction costs, is particularly important.[133]

These four components are essential to exploit the potentials of the knowledge-based economy. Even though good practices and institutional models provide some guidance in the formulation and implementation of national innovation systems, they should be adapted and specifically designed to suit the development level, industry specialization, legal system, and cultural traditions of each country.[134] In addition, policy adjustment is a continuous process of improvement, and both public and private stakeholders are responsible to coordinate these four components to produce an optimal result.

2.5 Innovation Systems in Developing and Developed Countries

It is my contention that innovation is present in both developing and developed countries and manifests itself in different forms depending on the development level and technical sophistication of each country. In low-income developing countries, innovation is more about the adoption and absorption of existing technologies in the local market.[135] In middle-income developing countries, innovation consists of technology adaptation and continuous improvement in product design and production process. For example, Brazilian farmers adapt foreign technologies to local conditions and improve productivity and market

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[133] World Bank, *Global Economic Prospects 2008: Technology Diffusion in Developing Countries*, (Washington, D.C.: World Bank, 2008).
[134] Daniel Gervais, "Of Clusters and Assumptions: Innovation as Part of a Full TRIPS Implementation" (2009) 77 Fordham L. Rev. 2353.
[135] Keith Maskus observes that "[d]efining innovation is extremely difficult in the context of a developing country. Many forms of adaptation, absorption, and even creative imitation can be legitimate manifestation of innovation." See Keith E. Maskus, *et al*., "Intellectual Property Rights and Economic Development in China", in Carsten Fink & Keith M. Maskus, eds., *Intellectual Property and Development: Lessons from Recent Economic Research*, (Washington, DC: World Bank, 2005) 295 at 325.

share.[136] In China, dual SIM card mobile phones are designed to improve product function and better meet users' needs.[137] Another example is that streamlined marketing strategies and modifications to manufacturing processes promote cost innovation in China.[138]

The relevant contexts for studying innovation in developing countries are imitative innovation in local communities, among indigenous peoples, and in the informal sectors. As WIPO emphasizes in its 2011 report entitled, *The Changing Face of Innovation*,[139] incremental product and process improvements and more local forms of innovation constitute a large portion of innovation in developing countries. Further, a large percentage of entrepreneurial activities found in developing countries take place in informal economic sectors and are not tracked as part of official statistics. Moreover, regional imbalances are prevalent in developing economies. In this context, it is advisable to create special economic zones or high-tech developmental zones to test innovation policy on a smaller scale. In addition, the public sector element of innovation systems in developing countries is often comprised of poorly coordinated and overly-crowded bureaucracies with overlapping mandates and fragmented specializations. Their functions range widely from stimulating export, to attracting foreign investment, to developing industrial clusters.

While innovation systems may vary from one country to another according to their development levels and technical conditions, certain principles are true to all innovation

[136] Alberto Rodriguez, with Carl Dahlman & Jamil Salmi, *Knowledge and Innovation for Competitiveness in Brazil*, (Washington DC: World Bank, 2008).
[137] David Rowan, "Chinese Pirates Are Tech's New Innovators", Wired (June 1, 2010).
[138] Zeng Ming & Peter J. Williamson, *Dragons at your Door: How Chinese Cost Innovation is Disrupting Global Competition*, (Boston, MA: Harvard Business School, 2007), cited in Peter Yu, "Building the Ladder: Three Decades of Development of the Chinese Patent System", in Margo Bagley & Ruth Okediji, eds., *Global Perspectives on Patent Law*, (Oxford, UK: Oxford University Press, 2013).
[139] WIPO, *World Intellectual Property Report 2011 – The Changing Face of Innovation*, available online: <http://www.wipo.int/econ_stat/en/economics/wipr/>.

systems. That is why the experiences of developed countries' innovation policy can help to inform effective approaches to innovation in developing countries. On the other hand, there is an urgent need to study specific challenges facing entrepreneurs and potential innovators in developing countries and better serve their technical, financial, and commercial needs.

2.6 Conclusion

This chapter discussed the wildly diverse modes of innovation and highlighted their dynamic and systematic characters. The emergence of open and collaborative innovation models and the globalization of innovation processes have enabled innovation capabilities of ordinary people and decentralized innovation resources. Further, the value of innovation tends to increase with more people using it. Innovation, as an intrinsic public good, has spillover effects and positive externalities and thus can promote equitable distribution of social welfare. A government should provide a proper patent protection level as well as complementary innovation incentives such as grants, education, and paying inventors one time fees to allow public use.

Chapter Three: An Innovation Capability Approach to Development

3.1 Introduction

Human development and social progress have long been pursued by human societies and occupied the agendas of international institutions. For instance, the United Nations' Millennium Development Goals (MDGs) represent a commitment by governments to eradicate poverty through a global partnership for sustainable development.[1] Similarly, the two most important international institutions responsible for intellectual property standards setting—the WTO and WIPO—are both committed to promoting development.

In WTO agreements, there are special and differential treatment provisions such as provisions allowing longer transitional periods to developing countries and special arrangements for Least Developed Countries such as provisions for technical assistance.[2] In addition, the launch of the Doha Development Round of the WTO is an explicit acknowledgement of the imbalances resulting from previous rounds of trade negotiations and the central position of promoting development in the new round. As the Doha WTO Ministerial Declaration states, "[t]he majority of WTO members are developing countries. We seek to place their needs and interests at the heart of the Work Programme adopted in this Declaration. … We shall continue to make positive efforts designed to ensure that

[1] The MDGs consist of the following eight goals: ensuring environmental sustainability, developing a global partnership for development, eradicating extreme poverty and hunger, achieving universal primary education, promoting gender equality, reducing child mortality, improving maternal health and combating HIV/AIDS, malaria and other major disease. See Millennium Development Goals, online: UN <http://www.un.org/millenniumgoals/> (last visited August 31 2012). See also, United Nations Millennium Declaration, G A Res 2, UN GAOR 55th Sess, UN Doc A/RES/55/2, adopted on 8 September 2000, online: UN <http://www.un.org/millennium/declaration/ares552e.htm> (last visited August 31 2012).

[2] See a summary of the provisions contained in the WTO agreements in favour of developing countries, online: <http://www.wto.org/english/tratop_e/devel_e/anexii_e.doc>.

developing countries, and especially the least-developed among them, secure a share in the growth of world trade commensurate with the needs of their economic development."[3]

In 2007, the World Intellectual Property Organization (WIPO) adopted a set of 45 Development Agenda recommendations, which reiterated WIPO's mission to "promote creative intellectual activity" and "the transfer of technology to developing countries."[4] The adoption of the WIPO Development Agenda and the establishment of a Committee on Development and Intellectual Property (CDIP) are major steps toward recognizing the need for tailoring the intellectual property regime according to specific conditions of developing countries.

Despite multilateral efforts to promote development, never in history has humanity been so sharply polarized in standards of living and divided by markedly different levels of capabilities to pursue the values and goals a person has reasons to believe in. Research shows that the world's income is becoming more and more unequally distributed.[5] For example, the Human Development Report 1999 states, "Gaps in income between the poorest and richest people and countries have continued to widen. In 1960 the 20% of the world's people in the richest countries had 30 times the income of the poorest 20% - in 1997, 74 times as much."[6] Similarly, the International Monetary Fund states: "The average income in

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[3] Doha Ministerial Declaration, adopted on November 14, 2001, WT/MIN(01)/DEC/1, at para. 2. See also, Committee on Trade and Development, "Developmental Aspects of the Doha Round of Negotiations—Note by the Secretariat", WT/COMTD/W/143/Rev.3, May 22, 2007.

[4] See Development Agenda of WIPO, online: WIPO <http://www.wipo.int/ip-development/en/agenda/recommendations.html>. [WIPO Development Agenda]

[5] World Bank, *World Development Report 2013: Jobs*, (Washing DC: World Bank, 2012), online: <http://siteresources.worldbank.org/EXTNWDR2013/Resources/8258024-1320950747192/8260293-1322665883147/WDR_2013_Report.pdf >.

[6] See United Nations Development Program, *Human Development Report 1999*, (New York: Oxford University Press, 1999) at 36, online: <http://hdr.undp.org/en/media/HDR_1999_EN.pdf>.

the richest 20 countries is 37 times the average in the poorest 20—a gap that has doubled in the past 40 years."[7]

Income disparity is not the only indicator of the development gaps between the rich and the poor. What separates developed from developing countries, as Joseph Stiglitz correctly points out, is not just the disparity in resources, but also the disparity in knowledge.[8] Indeed, global divisions in science base, technological advancement, and, most crucially, innovation capability, are starker than global divisions of income. The disparity in knowledge is commonly indicated by and reflected in patent statistics.[9] For example, U.S. patent statistics show that "[i]t is roughly a 96-fold higher ratio of patents per capita in the top ten countries than in the rest of the world."[10] Furthermore, the bottom 128 countries ranked by total patents have 63% of the world's population, but just 0.75% of all the U.S. patents.[11] The entire African continent had essentially no patent in the year 2000.[12] This startling gap in commercialized technological innovation is not specific to patents in the U.S., but represents a common pattern in patent data worldwide, as evidenced by statistics from the European Union (EU) and the WIPO.[13]

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[7] International Monetary Fund, (December 2000) 37:4 Finance and Development, (Washington, D.C.: IMF, 2000) at 2.

[8] Joseph E. Stiglitz, "Economic Foundations of Intellectual Property Rights", (2008) 57 Duke L.J. 1693. This view was first articulated in Joseph E. Stiglitz, *More Instruments and Broader Goals: Moving Toward the Post-Washington Consensus*, World Institute for Development Economics Research Annual Lectures 2, reprinted in: Ha-Joon Chang, ed., *Joseph Stiglitz and the World Bank: The Rebel Within*, (London: Anthem, 2001) at 57-93.

[9] Patent statistic is a commonly used indicator of innovation performance despite concerns over the comprehensiveness and accuracy of using patent data to measure innovation.

[10] Jeffrey Sachs, "The Global Innovation Divide," (2003) 3 Innovation Policy and the Economy 131 at 132.

[11] *Ibid*., at 132.

[12] *Ibid*.

[13] For example, in the 1990s, almost 90% of all of the royalties and licensing fees on a worldwide basis were received by five countries: the US (58%), Japan (10%), the UK (9%), Germany (6%), and France (4%). See Economics and Statistics Division, *World Intellectual Property Indicators, 2011 edition*, (Geneva: World Intellectual Property Organization, 2011).

The above statistics point to one of the most contentious areas of development: the divide in the capability to access information and knowledge, and interrelatedly, the capability to innovate. On the one hand, knowledge is an important form of input into creating innovative ideas and transforming these ideas into wealth and social progress, while innovation is a driving force to improve the social, economic, environmental, and political conditions of the poor. In modern capitalist economies, knowledge has become the key factor of production and perhaps the most important factor in determining the standard of living.[14] Economic historian Joel Mokyr has persuasively argued that improvement in the production and diffusion of human knowledge is the most fundamental factor driving economic growth generally and key advances in social welfare particularly.[15] Robert Solow showed that the injection of new technology into an economy is the single most powerful factor for promoting growth.[16] Edwin Mansfield maintained that the introduction of new technology into an economy has a very high social rate of return.[17] In short, knowledge inputs and how to organize resources in producing innovative outputs are two key elements of development.

On the other hand, knowledge has become increasingly difficult to access due to the ever stringent intellectual property protection. Intellectual property laws have traditionally been justified as necessary incentives for innovation. For example, the pharmaceutical industry has persistently advocated that strong patent rights are required for medical

[14] World Bank, *World Development Report 1998: Knowledge for Development*, (Washington, D.C.: World Bank, 1998) at 16.
[15] Joel Mokyr, *Gifts of Athena: Historical Origins of the Knowledge Economy*, (Princeton, NJ: Princeton University Press, 2002).
[16] Robert M. Solow, "A Contribution to the Theory of Economic Growth", (1956) 70:1 Quarterly Journal of Economics 65.
[17] Edwin Mansfield, "Microeconomics of Technological Innovation", in B. Guile & H. Brooks, *Technology and Global Industry*, (Washington, D.C., National Academy Press, 1987) at 307-326.

innovation and drug development.[18] It has also been said that without copyright protection innovation in the area of computer software would be greatly hampered.[19] Similar arguments were raised in the global trading regime:

> … [t]o encourage innovation, facilitate progress and expedite improvement in standards of living around the globe, intellectual property needs to be protected from current widespread piracy. Without the limited periods of market exclusivity afforded by patent, copyright, trademarks and so on, to encourage innovation the wheels of progress would turn far too slowly.[20]

However, there is a disjunction between the promise of intellectual property laws and their implementation in practice.[21] It is true that historically intellectual property protection has played an important role in promoting innovation and economic growth in some countries during their industrialization. This does not mean that intellectual property protection is imperative for all countries under any economic conditions or development levels. Furthermore, even when intellectual property laws are proven to be effective in spurring innovation within a country, its implementation on a global scale could be problematic because of the differing capabilities of countries to exploit human ingenuity and profit from intellectual production. In fact, the increasing global standards of intellectual property protection have adverse impacts on governments' ability to provide their citizens with key development resources, such as adequate food, accessible education, and affordable medicines. The lack of access to technology and knowledge has hampered innovation and

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[18] Gaia Bernstein, "In the Shadow of Innovation", (2010) 31:6 Cardozo Law Review 2257 at 2264.
[19] Gustavo Ghidini & Emanuela Arezzo, "Patent and Copyright Paradigms vis-à-vis Derivative Innovation: The Case of Computer Programs", (2005) 36:2 IIC 159-173. The United States, Japan, and the European Union are among the first to extend copyright protection to computer programs. See Pamela Samuelson, *et al*., "A Manifesto Concerning the Legal Protection of Computer Programs", (1994) 94 Colum. L. Rev. 2308 at 2313.
[20] Judith H. Bello & Alan F. Holmer, "The Uruguay Round: Where Are We?" (1991) 25 Int'l L. 723.
[21] See generally, WHO, Report of the Commission on Intellectual Property, Innovation and Public Health, (Geneva: WHO, 2006), available online: <http://www.who.int/intellectualproperty/documents/thereport/ENPublicHealthReport.pdf>.

curtailed the cultivation of innovation capabilities.[22] As a result, there seems to be a positive correlation between the increasing global standards of intellectual property protection and the widening gap between countries' capabilities to benefit from the creativity and ingenuity of their population.[23] Therefore, it is necessary to prevent and control the negative impacts of overprotection and abuse of intellectual property rights on technology transfer, information flow, knowledge access, innovation capability, global social welfare, and equitable human development.[24]

This chapter proposes a conceptual framework—an Innovation Capability Approach (ICA)—for promoting multi-dimensional and equitable development through enhancing innovation capabilities of people, enterprises, public institutions, and nations at large. It argues that cultivating innovation capabilities is a profitable avenue for promoting people's civil, political, social, economic, and cultural rights and thereby is *sine qua non* for realizing sustainable and equitable development. Although developing countries have been marginalized by the neoliberal global political and economic order to remain exporters of exhaustible natural resources and repositories of cheap labor, their most valuable, but least exploited resource—intellectual resource or human ingenuity[25]—can provide a profitable avenue for promoting people's civil, political, social, economic, and cultural rights and thereby sustainable and equitable development.

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[22] United Nations Development Programme, *Human Development Report 2001: Making New Technologies Work for Human Development*, (New York: Oxford University Press, 2001) at 103-105.
[23] Sudip Chaudhuri, "Is Product Patent Protection Necessary to Spur Innovation in Developing Countries?" in Neil Weinstock Netanel, ed., *The Development Agenda: Global Intellectual Property and Developing Countries,* (New York: Oxford University Press, 2009) at 265-288.
[24] UNDP, *Human Development Report 1999: Globalization with a Human Face*, (New York: Oxford University Press, 1999) at 68, online: <http://hdr.undp.org/en/media/HDR_1999_EN.pdf>.
[25] Human ingenuity is the human capability to create and use in novel ways, ideas to solve technological and social problems. See Thomas Homer-Dixon, *The Ingenuity Gap*, (New York: Alfred A. Knopf, 2000); and Thomas Homer-Dixon, "The Ingenuity Gap: Can Poor Countries Adapt to Resource Scarcity?" (1995) 21:3 Population and Development Review, 587-612, online: <http://www.library.utoronto.ca/pcs/ingen/ingen.htm> (last visited August 30, 2012).

This chapter proceeds as follows: Section two reviews the paradigmatic shift of our understanding of the development process from one based on pure economic growth to one based on rights and equity. Section three starts with an introduction of Amartya Sen's analytical framework and the organic definition of development as empowerment and enlargement of freedoms and capabilities. It then examines Martha Nussbaum's "central capabilities" approach and points out that the innovation dimension of human development has rarely been addressed comprehensively by either Sen or Nussbaum or in the growing literature on the capability approach. Given the paramount role of innovation in transforming the landscape of economies and quality of life, I propose an innovation capability approach that enables the optimal utilization of intellectual resources and the maximum harnessing of innovation capabilities for development. One caveat should be emphasized. Since development is too broad a concept to explore fruitfully, I will limit my analyses to the domain of law and development, notwithstanding the preliminary overview of theories of development economics. In particular, my focus will be on the role that the legal and regulatory framework for patent protection and innovation promotion could play towards economic growth and human development.

3.2 Evolving Development Paradigms

The TRIPS preamble recognizes development as one of "the underlying public policy objectives of national systems for the protection of intellectual property."[26] Since the meaning of "development" is not self-explanatory, this section aims to properly define "development". I will first review mainstream economic development theories and critically evaluate the strengths and weaknesses of the traditional/quantitative conception of and the

[26] TRIPS Agreement, *supra,* note 1 in chapter 1, Preamble.

economic approaches to development. I will then examine how the definition of "development" has evolved from a quantitative economic concept that focuses predominantly on growth to a qualitative human rights-based notion of substantive equality in development opportunities and distributive justice in development resources. More specifically, the concepts of "the Right to Development" and "substantive equality" in a human rights-based development framework will be analyzed.

3.2.1 The Traditional/Quantitative Conception of and Economic Approach to Development

Development theories aim to explain "how development should or might occur."[27] Focusing on the economic dimension of development, the traditional development theories understand development as a pure economic concept that celebrates "economic growth" as the sole objective and uses "growth-oriented statistics" as development benchmarks.[28] For example, Cypher and Dietz state that development is an economic concept that deals with "the search for an optimal growth path, or at least one that is superior to the existing allocation of resources and current efficiency levels."[29] Similarly, Michael P. Todaro defines economic development as the capacity of any given society to generate and sustain a steady annual increment in its gross national product (GNP).[30] With respect to trade policy,

[27] Robert B. Potter, "Theories, Strategies and Ideologies of Development" in Vandana Desai & Robert B. Potter, eds., *The Companion to Development Studies*, 2d ed., (London: Hodder Education, 2008) at 67.
[28] Daniel D. Bradlow, "Differing Conceptions of Development and the Content of International Development Law", (2005) 21 S. Afr. J. on Hum. Rts. 47.
[29] See James M. Cypher & James L. Dietz, "An Overview of Economic Development", in James M. Cypher & James L. Dietz, *The Process of Economic Development*, 2d. ed., (London: Routledge, 2004) at 17. Cypher and Dietz suggest that changes to economic institutions could be a primary way of increasing economic growth and identify the following institutional changes: growth of industrialization; decrease in the role of agriculture; mature trade; increasing productivity of labour through human capital accumulation; changing infrastructure; and social, political and legal institutions.
[30] See Michael P. Todaro, *Economic Development in the Third World*, 4th ed., (New York: Longman Inc., 1989) at 86. Michael P. Todaro suggests that GNP index is a good measurement for economic performances,

traditional theorists advise developing states to follow the precepts of classical economic trade theory by specializing in areas in which they possess a comparative advantage, such as agriculture and the export of raw resources.[31]

Two main categories of traditional development theories that I wish to explore are: the modernization theory, which has its root in Max Weber's philosophy about the function of law in economic development, and the dependency theory which originates from the writings of Marx and Engels.[32] I choose to discuss these theories because they represent the general characteristics of traditional development theories as a whole. I will argue that traditional development theories reduce development to simple mathematical calculations and thus ignore the human impact of poverty and the social, cultural, political, and institutional dimensions of development.

The modernization theory assumes that developing countries will achieve economic growth in the same way as developed countries have. It stresses material attainment and economic growth through the creation of a capitalist free-market economy and Western democratic modern society.[33] According to a leading modernization theorist, Walter Rostow, all societies progress towards Western-style industrial economies, which provide for prosperity and freedom, through sequential evolutions.[34] More specifically, Rostow contends

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but not for living standards or the quality of life for people. Todaro thus proposes a shift of emphasis from pure statistics to the reduction or elimination of poverty, unemployment, inequality and disease.

[31] Stuart Hall, "The Rest and the West: Discourses and Power," in Stuart Hall, *et al*., eds., *Modernity: An Introduction to Modern Societies,* (Cambridge, MA: Blackwell Publishers, 1996) at 185. See also, Benjamin Mason Meier & Ashley M. Fox, "Development as Health: Employing the Collective Right to Development to Achieve the Goals of the Individual Right to Health", (2008) 30 Human Rights Quarterly 259-355.

[32] Rumu Sarkar, *International Development Law: Rule of Law, Human Rights, and Global Finance*, (Oxford, UK: Oxford University Press, 2009) at 46-59. [Sarkar, *International Development Law*] See also, Lan Cao, "Law and Economic Development: A New Beginning", (1997) 32 Texas Int'l L. J. 545 at 546-554.

[33] *Ibid*., at 38.

[34] Walt W. Rostow, *The Stage of Economic Development: A Non-Communist Manifesto*, 3d ed., (Cambridge, UK: Cambridge University Press, 1990) at 4-16. [Rostow, *The Stage of Economic Development*]

that such evolutionary development necessarily involves the following five stages of a linear process: (1) traditional societies characterized by subsistence agriculture; (2) the creation of the preconditions for industrialization; (3) the "take-off" of industrial development and capitalist economic growth; (4) the mature capitalist state with a sustained level of economic productivity and greater linkages with the international economy; and finally, (5) the thriving of a system of "high mass consumption".[35] In addition to market-led economic reforms, the modernization theory prescribes that Western liberal legal and institutional framework should be adopted by any developing country who aspires to the kind of development process experienced in Western states.

In my view, the modernization theory does not duly appreciate the systemic subordination of, as well as the institutional discrimination against, developing countries that characterized most of the postwar international law and politics. The modernization concept of "development", as Ruth Gordon and Jon Sylvester argue, is "a set of practices and beliefs that are part of the Western political and cultural imagination, despite being presented as universal, natural and inevitable."[36] The modernization theory "presumes a universal and superior way of ordering society" and undervalues non-Western "cultures, economies, self-concepts, and ways of existing."[37] Similarly, Balakrishnan Rajagopal argues that the post WWII development ideology in international law is deeply rooted in the ideology of

[35] *Ibid*. See also, Colin Leys, "Samuel Huntington & the End of Classical Modernization Theory", in James Currey, ed., *Rise and Fall of Development Theory,* (Nairobi: EAEP; Bloomington: Indiana University Press, 1996) at 64.

[36] Ruth E. Gordon & Jon H. Sylvester, "Deconstructing Development", (2004) 22 Wis. Int'l L. J. 1 at 4. [Gordon & Sylvester, "Deconstructing Development"]

[37] Gordon and Sylvester conclude that "in the name of modernization, … [t]he concept of development privileges certain societies, cultures and institutions, while disparaging others; it is grounded in defining the 'Other' as incompetent, inferior and in need of transformation." *Ibid*.

colonialism, replete with ideas of Western modernity, progress, and superiority.[38] Hence, the rhetoric of development as Western-style modernization decries traditional societies and coerces fundamental transformation of their institutions and legal systems.

The second main category of traditional development theories—dependency theory—was first developed by Latin American scholars including Celso Furtado, Raul Prebisch, Theotonio Dos Santos, Osvaldo Sunkel, and Fernando Henrique Cordoso in the 1950s.[39] The central tenet of the dependency theory is that the "periphery" (i.e., the developing countries) is impossible to develop due to the dominance of the "metropole" (i.e., the developed countries). Dependency theorists argue that "developing countries are not just behind the economically advanced countries but remain subordinated to them by various mechanisms that must be abolished by radical change from below."[40] For example, the American economist Andre Gunder Frank posits that "the development of the West, the 'metropoles', has been made possible by the subordination and exploitation of the former colonies, the 'periphery', at the expense of the periphery's stagnation and impoverishment, and continued to be so."[41] In my view, most developing countries, which are on the periphery of the international trade system, have been marginalized to remain exporters of exhaustible natural resources and repositories of cheap labour.[42] This marginalization, in turn, perpetuates economic dependency and triggers more lethal forms of dependency, such

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[38] Balakrishnan Rajagopal, *International Law from Below: Development, Social Movements and Third World Resistance*, (New York: Cambridge University Press, 2003) at 25.
[39] D.F. Greenberg, "Law and Development in Light of Dependency Theory", in Anthony Carty, *Law and Development: The International Library of Essays in Law and Legal Theory,* (New York: New York University Press, 1992).
[40] John S. Saul & Colin Leys, "Dependency" in David Alexander Clark, ed., *The Elgar Companion to Development Studies*, (Cheltenham, UK: Edward Elgar, 2006) at 111.
[41] *Ibid*., at 112. See also, Andre Gunder Frank, *Latin America: Underdevelopment or Revolution: Essays on the Development of Underdevelopment and the Immediate Enemy,* (New York: Monthly Review Press, 1969.)
[42] Ruth Gordon, "Contemplating the WTO from the Margins", (2006) 17 Berkeley La Raza L. J. 95 at 96.

as technological and informational dependency and institutional and legislative dependency.[43]

In conclusion, the traditional development theories examined in this section view development as economic growth that can be distinguished from other social, cultural, environmental and political development. This view has been criticized by the more holistic "right and equality" approach to development, which will be presented in the next section.

3.2.2 The Qualitative Conception of and "Right and Equality" Approach to Development

The qualitative alternative approach to development deems development not purely as mathematical logic, but as a human endeavour in its context and complexity. The Austrian school of philosophers and economists have the distinct tradition of enthusiastically advocating for individual rights and freedom in economic studies.[44] More recently, an emerging global movement views development not simply as economic growth and modernization, but as a complex and integrated process of improving people's general living conditions and social, economic, cultural, political and environmental well-being.[45]

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[43] "Developed country corporations design ICTs for developed country conditions, resulting in new forms of dependency when these technologies are exported to the South… ICT4D's implicit assumption that technological innovations are designed in a neutral scientific realm aloof from social, economic, and political spheres and naturally flow into everyday life thus ignores contentious issues related to the power play and corporate interests behind R&D." See Veva Leye, "Information and Communication Technologies for Development: A Critical Perspective", (2009) 15 Global Governance 29 at 31-32.

[44] Karl R. Popper, *The Open Society and its Enemies,* (London: G. Routledge, 1945); Friedrich A. von Hayek, *The Constitution of Liberty,* (Chicago: University of Chicago Press, 1960); Joseph Schumpeter, *Capitalism, Socialism and Democracy,* (London: George Allen & Unwin, 1947); Ludwig von Mises, *On Freedom and Free Enterprise,* (Princeton, N.J.: Van Nostrand, 1956).

[45] Daniel D. Bradlow, "Differing Conceptions of Development and the Content of International Development Law", (2005) 21 S. Afr. J. on Hum. Rts. 47 at 47.

In my view, the qualitative conception of and human rights-based approach to, development is more preferable to the quantitative conception of and economic approach to development. This is because the latter does not capture certain dimensions of human development as comprehensively as the former does. Examples include such dimensions of human development as health, knowledge, spirituality, participation and environmental integrity. The human rights-based approach to development is more aligned with the multi-dimensional development of individuals and societies. Therefore, this thesis will take the more holistic human rights-based approach to development with a view to advancing the thesis arguments more effectively.

In this section, I will first examine the historical background and conceptual foundations of the most prominent theory in the qualitative approach to development—the human right to development approach. I will then analyze the components of substantive equality in distributing development resources and accessing development opportunities.

I argue that national governments have the positive responsibility to fulfill their human rights obligations under various human rights instruments, while international institutions should promote fair development policies and effective international cooperation. In other words, states are obliged to establish politically and socially just governance systems and actively put in place policies and institutions that ensure satisfaction of everyone's fundamental needs for subsistence and equal distribution of development opportunities. The duty of the international community becomes relevant where the global economic and political order constitutes an obstacle to the enjoyment of the right to

development for many parts of the world population, especially in developing countries.[46] In particular, no single state is able to provide for global public goods including an international order that is conducive to the economic development of the most disadvantaged.

3.2.2.1 Development as a Human Right

The promotion of development, security, and human rights are the three main goals of the United Nations (UN).[47] Article 55 of the UN Charter provides:

> … the United Nations shall promote: (a) higher standards of living, full employment, and conditions of economic and social progress and development; (b) solutions of international economic, social, health, and related problems; and international cultural and educational cooperation; and (c) universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion.[48]

The duty-bearers identified by human rights instruments are both nation states and the international community.[49] The human rights obligations of a state are threefold.[50] First, the duty *to respect* means a state has the obligation (negative duty) to abstain from depriving a person of her rights. Second, the duty *to protect* means a state has the obligation to protect its citizens against acts that violate their human rights including those committed by private

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[46] Felix Kirchmeier, "The Right to Development – Where do we stand? State of the Debate on the Right to Development", July 2006, Dialogue on Globalization Occasional Paper.

[47] Manfred Nowak, "Three Pillars of the United Nations: Security, Development and Human Rights", in Margot E. Salomon, Arne Tostensen & Wouter Vandenhole, eds., *Casting the Net Wider: Human Rights, Development and New Duty-Bearers,* (Antwerp, Oxford: Intersentia, 2007) at 25.

[48] UN Charter, Article 55, online: <http://treaties.un.org/doc/Publication/CTC/uncharter.pdf>. The Charter of the United Nations was signed on 26 June 1945, in San Francisco, at the conclusion of the United Nations Conference on International Organization, and came into force on 24 October 1945. The Preamble of the UN Charter states that "We the people of the United Nations [are] determined […] to reaffirm faith in fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women and of nations large and small […]."

[49] Margot E. Salomon, Arne Tostensen & Wouter Vandenhole, eds., *Casting the Net Wider: Human Rights, Development and New Duty-Bearers*, (Antwerp, Oxford: Intersentia, 2007).

[50] Felix Kirchmeier, "The Right to Development – Where do we stand? State of the Debate on the Right to Development," July 2006, Dialogue on Globalization Occasional Paper. See also, Ping Xiong, *An International Law Perspective on the Protection of Human Rights in the TRIPS Agreement: An Interpretation of the TRIPS Agreement in Relation to the Right to Health*, (Leiden: Martinus Nijhoff Publishers, 2012).

actors. Third, the duty *to fulfill* implies that the state, by means of legislation, must create a framework that enables the realization of those human rights.[51]

The first-generation human rights refer to those contained in the *International Covenant on Civil and Political Rights* (ICCPR) and are established to guarantee individual freedoms in the aftermath of eighteenth-century revolutionary struggles of Europe and North America.[52] The second-generation human rights are those contained in the *International Covenant on Economic, Social and Cultural Rights* (ICESCR). They were established in the nineteenth- and twentieth-century to advance social justice and struggle against economic exploitation.[53]

Quincy Wright distinguishes the first generation of human rights, which is based on individual rights, and the second generation of human rights, which is based on social rights:

> Individual rights are in the main correlative to negative duties of the State, and social rights are in the main correlative to positive duties of the State. Individual rights require that the State abstain from interference with the free exercise by the individual of his capacities, while the social rights require that the State interfere with many things the individual would like to do.[54]

In other words, the first-generation rights invoke the duty of a state to respect and protect, while the second-generation rights invoke the duty of a state to protect and fulfill.

The third-generation human rights emerged in the late twentieth century and include rights to humanitarian assistance, peace, a clean environment, development, and the common

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[51] Polly Vizard, Sakiko Fukuda-Pass, & Diane Elson, Introduction, in Diane Elson, Sakiko Fukuda-Parr & Polly Vizard, eds., *Human Rights and the Capabilities Approach,* (London: Routledge, 2012) 1 at 7.
[52] Khurshid Iqbal, *The Right to Development in International Law: The Case of Pakistan*, (London, UK: Routledge, 2010) at 1.
[53] *Ibid*.
[54] Quincy Wright, "Relationship between Different Categories of Human Rights" in United Nations Educational, Scientific and Cultural Organization, *Human Rights: Comments and Interpretations*, UNESCO/PHS/3(rev.) Paris, July 25, 1948, at 147, online: UNESCO <http://unesdoc.unesco.org/images/0015/001550/155042eb.pdf> (last visted 19 December 2012).

heritage of mankind.[55] According to Stephen Marks, the main aim of the third-generation human rights is to advance global public goods.[56] The right to development was a very controversial right among the third-generation human rights. It is based on the idea of "need as a basis for entitlement"[57] and characterized by both individual right and collective right. The right to development generally refers to:

> … the *individual right* to benefit from a development policy based on the satisfaction of material and nonmaterial human needs and to participate in the development process, and the *collective right* of developing countries (and "peoples" not yet having exercised their right to self-determination) to succeed in establishing a new international economic order, that is, in eliminating the structural obstacles to their development inherent in current international economic relations.[58]

The idea of development as a human right was introduced into the international debate in the 1950s and 1960s in the context of the sharp increase of developing countries due to decolonization and their demand for a new international economic order.[59] The former president of the UN Commission on Human Rights, the Senegalese jurist Kéba Mbaye, was one of the first experts to refer to a right to development, which he defined as "the recognized prerogative of every individual and every people to enjoy in just measure the goods and services produced thanks to the effort of solidarity of the members of the

[55] Stephen P. Marks, "Emerging Human Rights: A New Generation for the 1980s", (1981) 33 Rutgers L. Rev. 435.
[56] Stephen Marks, "The Human Right to Development: Between Rhetoric and Reality", (2004) 17 Harv. Hum. Rts. J. 137 at 138.
[57] Oscar Schachter writes: "The present rationale for international assistance and preferential treatment on the basis of need is more in keeping with the premises of the welfare state—that is, to provide for the minimal human needs of the most disadvantaged segments of society … thus there is increased acceptance of the idea that specially disadvantaged countries such as landlocked states or former colonial territories or states dependent on a single commodity have special needs that entitle them to preferential treatment." See Oscar Schachter, "The Evolving International Law of Development", (1976) 15 Colum. J. Transnat'l L. 1 at 10.
[58] *Supra,* note 55 in chapter 3, at 445.
[59] Philip Alston, "Making Space for New Human Rights: The Case of the Right to Development", (1988) 1 Harv. Hum. Rts. Y.B. 3.

community."[60] The right to development was first recognized as a human right by the UN Commission on Human Rights in a resolution approved in February 1977.[61] The right to development was officially adopted, though still with opposition, in 1986 in the *UN Declaration on the Right to Development*.[62] In 1993, at the World Conference on Human Rights, 171 member states unanimously adopted the Vienna Declaration and Programme of Action, which proclaimed the right to development as "a universal and inalienable right and an integral part of fundamental human rights."[63]

The Preamble of the *UN Declaration on the Right to Development* recognizes that "development is a comprehensive economic, social, cultural and political process, which aims at the constant improvement of the well-being of the entire population and of all individuals on the basis of their active, free and meaningful participation in development and the fair distribution of benefits resulting therefrom."[64] Article 1(1) of the *Declaration on the Right to Development* defines "the right to development" as "an inalienable human right by virtue of which every human person and all peoples are entitled to participate in, contribute

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[60] Kéba Mbaye, "Chairman's Opening Remarks", in the International Commission of Jurists, ed., *Development, Human Rights, and the Rule of Law*, (Oxford: Pergamon, 1981) at 7. See also, Judge Kéba Mbaye, Le Droit au Développement Comme un Droit de L'Homme [The Right to Development as a Human Right], Lecon inaugurale de la Troisième Session d'enseignement de l'Institut International des Droits de L'Homme [Inaugural Address of the Third Teaching Session of the International Institute of Human Rights] (July 3, 1972), in 5 Revue des Droits de L'Homme [(1972) 5 Human Rights Journal, 505].

[61] This resolution called on the UN Economic and Social Council to invite the Secretary-General to undertake a study on "the international dimensions of the right to development as a human right in relation with other human rights based on international cooperation, including the right to peace, taking into account the requirements of the New International Economic Order and the fundamental human needs." See Report of the 33rd Session, Commission on Human Rights, 62 U.N. ESCOR, Supp. (No. 6) 74, 75, UN Doc. No. E/5927, E/CN.4/1257 (1977). See also, Fatsah Ouguergouz, *The African Charter on Human and Peoples' Rights: A Comprehensive Agenda for Human Dignity and Sustainable Democracy in Africa,* (The Hague: Martinus Nijhoff, 2003) at 300.

[62] Siobhan Mcinerney-Lankford, "Human Rights and Development: A Comment on Challenges and Opportunities from a Legal Perspective", (2009) 1 Journal of Human Rights Practice 51-82.

[63] See Vienna Declaration and Programme of Action: Note by the Secretariat, World Conference on Human Rights, Part I, at 10. UN Doc. A/CONF.157/23 (1993).

[64] United Nations, General Assembly, Declaration on the Right to Development, 41st Sess., Annex, Agenda Item 101, 97th plen. mtg., U.N. Doc. A/RES/41/128 (December 4, 1986), online: UN <http://www.un.org/documents/ga/res/41/a41r128.htm>.

to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized".[65]

According to the *UN Declaration on the Right to Development*, the right to development includes:

> … full sovereignty over natural resources; self-determination; popular participation in development; equality of opportunity; the creation of favourable conditions for the enjoyment of other civil, political, economic, social and cultural rights.[66]

The objectives of the right to development have been summarized as:

> "The right [to development] seeks to address complex issues of equality, fairness, distribution of benefits and burdens within and among societies. The right focuses on solving problems of exploitation and oppression, fulfilling basic human needs, and maintaining respect for all persons. It serves as a reminder of our responsibility to future generations. Finally, on a global scale, it raises the classic question of justice: how to render to each person what is due."[67]

It is now widely recognized that the right to inclusive and multi-dimensional human development should be fully integrated with human rights protection.[68] Increasingly, the right to development is being recognized by international organizations and entrenched in both international human rights and development instruments. For instance, the Millennium Declaration makes reference to the right to development:

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[65] United Nations, General Assembly, Declaration on the Right to Development, 41st Sess., Annex, Agenda Item 101, 97th plen. mtg., U.N. Doc. A/RES/41/128 (December 4, 1986), online: UN <http://www.un.org/documents/ga/res/41/a41r128.htm>. ["UN Declaration on the Right to Development"] Arjun Sengupta describes three principles contained in this first article of the Declaration as follows: "(a) there is an inalienable human right that is called the right to development; (b) there is a particular process of economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized; and (c) the right to development is a human right by virtue of which every human person and all peoples are entitled to participate in, contribute to and enjoy that particular process of development." Felix Kirchmeier, "The Right to Development – Where do we stand? State of the Debate on the Right to Development," July 2006, Dialogue on Globalization Occasional Paper at 9.

[66] *Ibid*.

[67] Isabella D. Bunn, "The Right to Development: Implications for International Economic Law", (2000) 15 Am. U. Int'l L. Rev. 1425 at 1447.

[68] Margot E. Salomon, Arne Tostensen & Wouter Vandenhole, eds., *Casting the Net Wider: Human Rights, Development and New Duty-Bearers*, (Antwerp, Oxford: Intersentia, 2007).

> We will spare no effort to free our fellow men, women and children from the abject and dehumanizing conditions of extreme poverty, to which more than a billion of them are currently subjected. We are committed to making the right to development a reality for everyone and to freeing the entire human race from want.[69]

Notwithstanding the ever-increasing emphasis of human rights in the development process, challenges are abound for the full implementation of the right to development in practice. First, the right to development has not transcended the state of soft law and yet reached the status of a legally-binding instrument. Second, the right to development has not fully embraced a legal norm of "substantive equality" in practice. The next section will discuss the latter in detail.

3.2.2.2 Development as Substantive Equality

The common-sense understanding of formal equality is that like cases should be treated alike. This principle is appealing intuitively and central to the notions of coherence, predictability, justice, and fairness. Arguably, there are some conceptual problems with the application of formal equality in the context of international law. First, formal equality requires states to be treated alike, regardless of their different needs and capabilities to convert resources into valuable achievements. However, it is not clear what criteria should be used to define likeness and difference under the formal equality approach. How do we decide what a "like country" is and how it could have different needs and abilities from another "like" country? Similarly, how do we decide what constitutes treating cases alike? Second, the formal equality approach raises the question of fairness as like treatment may nevertheless have varying effects on countries' capabilities to provide resources and opportunities for economic development.

[69] *Supra,* note 1 in chapter 3, at para. 11.

In contrast, substantive equality assesses different impacts of development policies on different societies and aims to achieve equality in substance and effect through differential treatment.[70] In human rights and social justice discourse, substantive equality is a well-established principle which recognizes that equal treatment in mere formality is unlikely to reduce institutional or systemic inequality. This is because not everyone has the same capacity to benefit from the opportunities which a society and its laws offer. Richard W. Wright writes: "In both theory and everyday practice, the concept of justice has long been thought to encompass not merely a formal equality (treating like cases alike), but also a substantive equality which requires giving each person his or her 'due'—what is his or hers as a matter of right—a requirement that is usually understood to be in direct conflict with the basic principles of aggregate social welfare theories such as utilitarianism or its modern variant, economic efficiency."[71] I am not suggesting that such reasoning in the social justice context, which is concerned with equality between people, can be directly applied to trade law, which is concerned with equality between countries. However, the substantive equality analysis provides an unorthodox perspective to delve into the often contentious trade and development debates.[72]

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[70] Milan Bulajic, *Principles of International Development Law: Progressive Development of the Principles of International Law Relating to the New International Economic Order,* (Boston: Kluwer, 1986) discussing the principle of preferential and non-reciprocal treatment for developing countries as a tool to change substantive inequity between developed and developing countries.

[71] Richard W. Wright, "The Principles of Justice", (2000) 75 Notre Dame L. Rev. 1859 at 1859-1860.

[72] Margaret Chon, Madhavi Sunder, and Lea Shaver have used substantive equality analysis in international intellectual property law. See Margaret Chon, "Intellectual Property Equality", (2011) 9 Seattle J. Soc. Just. 259; Margaret Chon, "Substantive Equality in International Intellectual Property Norm-Setting", *supra,* note 25 in chapter 1; Chon, "Copyright and Capability for Education", *supra,* note 49 in chapter 2; Madhavi Sunder, "Intellectual Property and Development as Freedom," *supra,* note 25 in chapter 1; Lea Bishop Shaver, "Defining and Measuring A2K: A Blueprint for an Index of Access to Knowledge," (Summer 2008) 4.2 I/S: A Journal of Law and Policy for the Information Society 235-269; Julie E. Cohen, *Configuring the Networked Self, supra,* note 24 in chapter 1.

The notion of substantive equality is explicitly recognized in the UN Declaration on the Right to Development. Article 8.1 provides that states are to ensure "*equality of opportunity* for all in their access to basic resources, education, health services, food, housing, employment and the fair distribution of income" (emphasis added). Further, Article 2.3 states that development policies are aimed "at the constant improvement of the well-being of the entire population and of all individuals"; and that all individuals are entitled to "the fair distribution of the benefits" resulting from development. Moreover, Article 6.1 requires state cooperation in promoting and observing "all human rights and fundamental freedoms for all without any distinction as to race, sex, language or religion." These articles imply the progressive transition of development thinking from ensuring formal equality to substantive equality. In addition, the UN Millennium Declaration recognizes "a collective responsibility to uphold principles of human dignity, equality and equity at the global level."[73] It affirms equality as one of the fundamental values essential to international relations in the twenty-first century: "No individual and no nation must be denied the opportunity to benefit from development. The equal rights and opportunities of women and men must be assured."[74]

The legal norm of substantive equality, however, has not been fully adopted in the development process.[75] On the contrary, it is widely recognized that "substantive inequality" exists in the relationship between developed and developing countries, and in particular that "the TRIPS Agreement is unsustainable unless we start to have more equity in its actual

[73] *Supra,* note 1 in chapter 3, at para 2.
[74] *Ibid*., at para 6.
[75] Roland Rich, "The Right to Development: A Right of Peoples?" in James Crawford, ed., *The Rights of Peoples*, (Oxford: Oxford University Press, 1988) 39 at 48-49.

use."[76] As noted by the Director-General of the WTO, "true equality can only exist between equals."[77] To bring about true, that is, substantive, equality between unequal countries, Lamy suggests "as in the case of domestic laws, where social legislation is an essential corollary to equal dignity of men and women …adaptation of applicable [WTO] rules to the real situation of States is a way of ensuring more genuine equality."[78] To paraphrase the now famous words of Justice Blackmun in his dissenting opinion in the *Bakke* case,[79] in order to get beyond systemic poverty, we must first take account of different capacities and development resources that countries have. And in order to treat developing countries equally with developed ones, we must treat them differently.

At the core of what substantive equality means for developing countries is the acceptance that treating developing countries identically in all respects with the developed countries can lead to the sense of oppression of development space that can fuel conflicts and development backlashes. Substantive equality, I suggest, would promote treating all countries with equal concern and respect, which often requires differential treatment. Following a substantive equality approach, underdevelopment is not the sole responsibility of an individual country, but a result of the systemic subordination of, as well as the institutional discrimination against, developing countries in the global economic order.[80]

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[76] Bruce A. Lehman, "Intellectual Property Rights as a Trade, Health and Economic Development Issue" (2003) 17 St. John's Journal of Legal Commentary 417, at 425.
[77] Pascal Lamy, "The Place of the WTO and its Law in the International Legal Order" (2006) 17 E.J.I.L. 969 at 973.
[78] *Ibid*.
[79] See *Regents of the Univ. of Cal. v. Bakke*, 438 U.S. 265, 407 (1978) (Blackmun, J., dissenting). "[i]n order to get beyond racism, we must first take account of race. There is no other way. And in order to treat some persons equally, we must treat them differently."
[80] Paul Ocheje argues that "poverty is a direct consequence of the discount of human rights in the development process" and proposes "a conceptualization of development as a comprehensive and ongoing process of societal improvement which is predicated on respect for all of human rights. Such a process must be people-centred, participatory, inclusive/non-discriminatory, and sustainable." Paul D. Ocheje, "The Domestic Dimension of the Right to Development in International Law," a thesis submitted to the Faculty of Graduate

International economic institutions have a positive obligation to prevent discriminatory effects of formal equality policies and ensure substantive equality and contribute to substantive freedom.

The special and differential treatment principle is an example similar to "positive discrimination" or "affirmative action" in a domestic context to allow and promote legislation that targets the inequalities that particular groups experience.[81] A similar concept of common but differentiated responsibility exists in the environmental regime.[82] Given the fact that countries are neither equally responsible for past environmental damages, nor do they possess equal resources to contribute to environmental protection or remedy, the *Rio Declaration on Environment and Development* acknowledges that countries share common responsibility toward environmental protection; however, they assume differentiated responsibilities for addressing environmental problems.[83] Moreover, the Doha Declaration particularly emphasizes the significance of technical assistance and capacity building in the trade and environment area to developing countries, in particular to the least-developed countries.

Studies in partial fulfillment of the requirements for the degree of Doctor of Jurisprudence, Osgoode Hall Law School, June 1999, at iv.

[81] See discussions on Special and Differential Treatments in TRIPS and the WTO legal system, Amin Alavi, "Special and Differential Treatments Provisions in the TRIPS Negotiations", (2008) 3:1 Journal of Intellectual Property Law & Practice 55; Amin Alavi, "On the (Non-)Effectiveness of the World Trade Organization Special and Differential Treatments in the Dispute Settlement Process", (2007) 41:2 Journal of World Trade 319; Manickan Supperamaniam, "Special and Differential Treatment for Developing Countries in the World Trade Organization", in Gary P. Sampson & W. Bradnee Chambers, eds., *Developing Countries and the WTO: Policy Approaches*, (New York: United Nations University Press, 2008) at 130-137; and Constantine Michalopoulos, "Special and Differential Treatment of Developing Countries in TRIPS", TRIPS Issues Paper No. 2, (Geneva: Quaker United Nations Office, 2003).

[82] Principle 7 of the Rio Declaration on Environment and Development reads: "States have common but differentiated responsibilities with regard to promoting sustainable development."

[83] Michael Weisslitz, "Rethinking the Equitable Principle of Common but Differentiated Responsibility: Differential versus Absolute Norms of Compliance and Contribution in the Global Climate Change Context", (2002) 13 Colo. J. Int'l Envtl. L. & Pol'y 473.

Applying a substantive equality principal, underdevelopment is a result of the systemic subordination of, as well as the institutional discrimination against, developing countries in the global economic order and the intellectual property regime. TRIPS minimum standards and national treatment are based on formal equality and have discriminatory effects on members with lesser innovation capability.[84] Therefore, it is important to recognize special and differential treatment as one of the fundamental principles of global innovation governance.

3.2.3 Conclusion

Development theorists have shifted their focus from studying development as an economic growth phenomenon and Gross National Product (GNP) to framing the right to development as a basic human right; from accumulation of wealth to fair and equitable distribution of social welfare; from gaps in physical, labour, and capital resources to gaps in knowledge resources and innovation capability. New approaches to development no longer define development as economic growth or industrialization, but as the full realization of human rights in the broad sense, encompassing civil, political, social, economic, and cultural rights.[85]

The centrality of development to the international community is recognized, along with peace and human rights, as one of three interrelated and basic objectives in the UN Charter. The recognition of the right to development in international law is the essential means to integrate human rights into a comprehensive and coherent development process

[84] *Supra,* note 29 in chapter 1, at 889-890.
[85] For the need to equate the concept of development with the universal realization of human rights, see, eg., Manfred Nowak, "The Human Right to Development versus Human-Rights-Based Development Co-operation", in R. Tetzlaff, ed., *Human Rights and Development*, (Bonn, Stiftung Entwicklung und Frieden, 1993) at 215.

which gradually shifts from regulating states relations to promoting people's welfare. Finally, equitable development is only attainable through ensuring equality of development resources and opportunities through differential treatment of those countries and groups which have been excluded from economic growth or discriminated against in the global economic order.[86]

3.3 Capability Approach to Development

In this section, I will critically examine the most important theoretical advancement under the conceptual framework of development as a human right—capability approach – popularized by scholars such as Amartya Sen and Martha Nussbaum.[87] I will point out the missing dimension of innovation in the capability approach and emphasize the significance of innovation capability as both a tool of current production and an investment for future growth.

3.3.1 Sen's Development as Substantive Freedom to Achieve Functionings

As a species of a human rights approach to development, the capability approach was theorized by scholars such as Amartya Sen and Martha Nussbaum. Sen criticizes the pure economic approach, arguing that human development goes beyond pure economic growth measured by income, or GNP, or industrialization and technological progress, or social modernization. Sen also criticizes the welfare or utility approach, pointing out that there is

[86] *Supra,* note 67.
[87] Amartya Sen's initial statement of this "capabilities approach" is in Amartya Sen, "Equality of What?" in Sterling McMurrin, ed., *Tanner Lectures on Human Values* Vol. I, (Cambridge, UK: Cambridge University Press, 1980), reprinted in Amartya Sen, *Choice, Welfare, and Measurement,* (Oxford, UK: Basil Blackwell, 1982). See also *supra,* note 23 in chapter 1.

more to life than achieving utility.[88] According to Sen, although the utility approach focuses on certain non-economic aspects of human existence, such as happiness, pleasure and desire-fulfillment, it fails to account for important intrinsic values, such as right, capability, and freedom.[89]

Sen's multi-dimensional account of development focuses on the quality of life that people live measured by the extent to which the *capabilities* of these people have been enabled by the *substantive freedoms* they enjoy.[90] As Sen states in *Development as Freedom*, the objective of development is to expand "the real freedoms that people enjoy" and promote valuable capabilities.[91] Sen argues that development's end goal is to empower people with certain human capabilities, such as the capability to live a healthy and long life and have access to education, while securing core freedoms, such as the freedom to participate in political life.[92] To Sen, development consists of the capabilities to avoid starvation and premature mortality, and the freedoms of political expression and having the ability to gain income and make economic decisions.[93]

It is necessary to clarify three central concepts in Sen's capability approach that are intimately connected with the thesis arguments: functioning, capability, and freedom. For

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[88] Sen states: "Happiness or desire fulfillment represents only one aspect of human existence." See Amartya K. Sen, *Resources, Values, and Development* (Oxford: Basil Blackwell, 1984) at 512.
[89] Amartya K. Sen, *Development as Freedom* (Oxford: Oxford University Press, 1999) at 77. [Sen, *Development as Freedom*]
[90] Sen states: "in analysing social justice, there is a strong case for judging individual advantage in terms of the capabilities that a person has, that is, the substantive freedoms he or she enjoys to lead the kind of life he or she has reason to value." *Ibid*., at 87.
[91] *Ibid*., at 6. See also his various essays in Amartya Sen, *Resources, Values, and Development,* (Oxford, UK: Basil Blackwell, 1984); Amartya Sen, *Commodities and Capabilities*, *supra,* note 26 in chapter 1; and Amartya Sen, "Well-Being, Agency, and Freedom: The Dewey Lectures 1984", (1985) 82:4 Journal of Philosophy 169.
[92] Amartya Sen, "Development as Capability Expansion," in K. Griffin & J. Knight, eds., *Human Development and the International Development Strategy for the 1990s,* (London: Macmillan, 1990) at 41-58.
[93] Julie Clague, "Patent Injustice: Applying Sen's Capability Approach to Biotechnologies", in Séverine Deneulin, Mathias Nebel & Nicholas Sagovsky, eds., *Transforming Unjust Structures: The Capability Approach,* (The Netherlands: Springer, 2006) at 177.

Sen, functionings refer to "the various things a person may value being and doing."[94] Functionings can be both elementary (being in good health and avoiding escapable morbidity and mortality) and complex (happiness, self-respect, participation in community life, ability to appear in public without shame). They can be general (being adequately nourished) or they can be specific (being able to drink a particular brand of milk). In my understanding, functionings are constitutive of a person's state of being and reflect the uses that she can make of her endowment at her free will.

The second important concept is capability. A person's capability is the person's ability to achieve valuable functionings and choose between them.[95] For Sen, capability represents "the various combinations of functionings (beings and doings) that the person can achieve. [It] is, thus, a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another … to choose from possible livings."[96] Sen sees capability as a kind of freedom—freedom in the sense of opportunity.[97] Capability is conceptualized as a reflection of the freedom to achieve valuable beings and doings and to lead one type of life or another.[98] Capabilities reflect a person's real opportunities or positive freedom to "choose between different ways of living."[99]

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[94] Sen, *Development as Freedom*, *supra,* note 89 in chapter 3, at 75. See also, Amartya K. Sen, *Commodities and Capabilities*, *supra,* note 26 in chapter 1, at 10.
[95] Amartya Sen, "Well-being, Agency and Freedom: The Dewey Lectures 1984", (April 1985) 82 Journal of Philosophy.
[96] Amartya Sen, *Inequality Reexamined*, (Oxford, UK: Clarendon Press, 1992) at 39.
[97] Amartya Kumar Sen, *Rationality and Freedom*, (Cambridge, MA: Belknap Press of Harvard University Press, 2002), in particular, Chapter 20 "Opportunities and Freedoms" at 583-622 and Chapter 22 "Freedom and the Evaluation of Opportunity" at 659-712. [Sen, *Rationality and Freedom*]
[98] *Supra* note 96 in chapter 3. See also, Amartya Sen, "Capability and Well-Being", in Martha Nussbaum & Amartya Sen, eds, *Quality of Life*, (Oxford: Clarendon Press, 1993) at 30.
[99] Amartya Sen, "Development as Capability Expansion," in Sakiko Fukuda-Parr & A.K. Shiva, eds., *Handbook of Human Development: Concepts, Measures, and Policies*, (Oxford: Oxford University Press, 2009) at 5.

With regard to freedom, Sen distinguishes "opportunity freedom" from "process freedom". While "opportunity freedom" refers to our *ability to achieve* valued functionings, "process freedom" refers to "the *process* through which things happen."[100] Freedom, for Sen, is "the *real opportunity* that we have to accomplish what we value."[101] A person's freedom is represented by having different choices of using our capabilities to achieve valuable functionings.[102]

According to Sen, there are two roles of freedom in development: the "constitutive role" and the "instrumental role." Sen writes:

> The constitutive role of freedom relates to the importance of substantive freedom in enriching human life. The substantive freedoms include elementary capabilities like being able to avoid such deprivations as starvation, undernourishment, escapable morbidity and pre-mature mortality, as well as the freedoms that are associated with being literate and numerate, enjoying political participation and uncensored speech and so on. … the effectiveness of freedom as an instrument lies in the fact that different kinds of freedom interrelate with one another, and freedom of one type may greatly help in advancing freedom of other types.[103]

For Sen, substantive freedoms are both the ends of, and means to human development;[104] and they have both the intrinsic value to individuals and the instrumental value to the society as a whole.[105]

Sen further lists five types of instrumental freedoms that should be promoted by development policy: political freedom, economic facilities, social opportunities,

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[100] Sen, *Rationality and Freedom, supra,* note 97 in chapter 3, at 585.
[101] *Supra,* note 96 in chapter 3, at 31.
[102] Amartya Sen, "Development as Capability Expansion", in Sakiko Fukuda-Parr & A.K. Shiva, eds., *Handbook of Human Development: Concepts, Measures, and Policies*, (Oxford: Oxford University Press, 2009).
[103] Sen, *Development as Freedom*, *supra,* note 89 in chapter 3, at 36-37.
[104] "Expansion of freedom is viewed…both as the primary end and as the principal means of development." *Ibid*., at 12.
[105] David A. Clark, "Capability Approach", in David Alexander Clark, ed., *The Elgar Companion to Development Studies*, (Cheltenham, UK: Edward Elgar, 2006) 32-45. [Clark, "Capability Approach"]

transparency guarantees, and protective security.[106] This list of freedoms captures both economic and political freedom and emphasizes the important role of democratic freedom in enhancing the general welfare and promoting development.[107] As political freedom and economic freedom reinforce one another, the development of human capabilities, Sen insists, cannot fully happen without political freedom. This is partially because political freedom allows social interactions and participation in civil and political affairs and public deliberations in collective decision-making, which are all critical to developing individual capabilities and promoting democracy. For the above reasons, development requires the removal of substantive unfreedoms: "poverty as well as tyranny, poor economic opportunities as well as social deprivation, neglect of public facilities as well as the intolerance or overactivity of repressive states."[108]

3.3.2 Nussbaum's Central Human Capabilities Approach

Martha Nussbaum, another prominent advocate for the capability approach to development, explains that the concept of development is about achieving "certain basic functional capabilities which societies should obtain for their citizens, and by which their quality of life should be measured."[109] Martha Nussbaum's capability approach differs from Sen's in several respects. The most notable difference is that Nussbaum draws heavily on Aristotle in an effort to develop a definite list of "central human capabilities."[110] Unlike Sen

[106] Sen, *Development as Freedom*, *supra,* note 89 in chapter 3, at 36-37.
[107] Amartya Sen, *Commodities and Capabilities*, *supra,* note 26 in chapter 1.
[108] "Development consists of the removal of various types of unfreedoms that leave people with little choice and little opportunity of exercising their reasoned agency. The removal of substantive unfreedoms, it is argued here, is constitutive of development." Supra, note 89 in chapter 3, at 12.
[109] Martha C. Nussbaum, "Capabilities and Human Rights" (1997) 66 Fordham Law Review 273 at 287.
[110] Martha C. Nussbaum, *Women and Human Development: The Capability Approach* (Cambridge: Cambridge University Press, 2000) at 72-75 [Nussbaum, *Women and Human Development*]; and Martha C. Nussbaum,

who advocates for *equality* of capabilities, Nussbaum argues that what is necessary is a *threshold* of capabilities.[111] Nussbaum thinks that this threshold secures what is essential for a life worthy of the dignity of a human being.[112] She proposes a list of "central human capabilities" and emphasizes that *each* of these capabilities has to be guaranteed constitutionally by governments for a person to function well and live a full life. In other words, fundamental justice is not served if any individual is below the threshold on any one of the central capabilities.

Nussbaum's central human capabilities are as follows:[113]

1. Life (Being able to live for the span normal for the species.)

2. Bodily health (Being able to have good health and in order to obtain this, adequate nourishment and shelter.)

3. Bodily integrity (Being able to be physically secure, and with rights over one's own body, e.g., not forced to lose capacity for sexual satisfaction or forced to conceive or bear children.)

4. Senses, imagination, and thought (Being able to use the senses, to imagine, think and reason, and to do this in a truly human way: adequately educated, informed and free from repression.)

5. Emotions (Being able to have attachments for other people and things.)

6. Practical reason (Being able to form a conception of the good and to engage in critical reflection for the planning of one's life.)

7. Affiliation (A. Being able to interact well with other people, and to imagine and empathize with their situation; B. Having the social bases for self-respect and non-humiliation; not being subject to discrimination on the grounds of race, sex, etc.)

"Well-being, Contracts and Capabilities," in Lenore Manderson, ed., *Rethinking Well-Being* (Perth: API Network, 2005) at 41-42.

[111] Martha C. Nussbaum, "Capabilities as Fundamental Entitlement: Sen and Social Justice," (2003) 9:2-3 Feminist Economics 33 at 41-42.

[112] Nussbaum defines capability as "what people are actually able to do and to be—in a way informed by an intuitive idea of a life that is worthy of the dignity of the human being." Nussbaum, *Women and Human Development, supra* note 110 in chapter 3, at 5.

[113] *Ibid*., at 78-80.

8. Other species (Being able to live with concern for the natural world.)

9. Play (Being able to play and laugh.)

10. Control over one's environment (Being able to participate in political processes; being able to have possessions and seek employment.)

Nussbaum's list of "central human capabilities" has remained largely unchanged since the appearance of her first list in 1990. For example, the version published in 1997 includes: "(1) Being able to live to the end of a human life of normal length; (2) Being able to have good health, including reproductive health; to be adequately nourished; (3) Being able to use the senses; being able to imagine, to think, and to reason – and to do these things in a 'truly human' way, a way informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training…."[114] The headings of central human capabilities in her 2007 publication are: life; bodily health; bodily integrity; senses, imagination and thought; emotions; practical reason; personal and political affiliation; relationships with other species and the world of nature; play; and material and social control over one's environment.[115]

Martha Nussbaum's initiative to list ten "central human capabilities" makes a valuable addition to the operation and application of the capability approach in practice. Nussbaum's articulation of a threshold level of core capabilities provides "a basis for *central constitutional principles* that citizens have a right to demand from their governments."[116] This list of "central human capabilities" constitutes the normative goal that societies should

[114] Martha C. Nussbaum, "Capabilities and Human Rights" (1997) 66 Fordham Law Review 273, at 287.
[115] See Martha Nussbaum, "Human Rights and Human Capabilities" (2007) 20 Harv. Hum. Rts. J. 21 at 23-24 (specifying each of the capabilities in Appendix A). See also, Martha C. Nussbaum, "Capabilities as Fundamental Entitlement: Sen and Social Justice," (2003) 9:2-3 Feminist Economics 33 at 41-42; Martha C. Nussbaum, "Well-being, Contracts and Capabilities," in Lenore Manderson, ed., *Rethinking Well-Being* (Perth: API Network, 2005) 27 at 41-42.
[116] Nussbaum, *Women and Human Development*, *supra,* note 110 in chapter 3, at 12.

pursue and defend in their political processes. In addition, Nussbaum's individualist approach of treating each person's welfare as an end in itself enlarges people's avenue of options and capabilities.[117] It therefore provides basic political principles that should be embodied in constitutional guarantees, human rights legislation and development policy.[118]

3.3.3 The Wide Adoption of Capability Approach in Development Practice

The capability approach has now been widely adopted by international development and research institutions. The Office of the UN High Commissioner for Human Rights has defined "poverty," based on Amartya Sen's substantive freedom and capability approach,[119] as "the absence or inadequate realization of certain basic freedoms or human rights, such as the freedom to avoid hunger, disease, illiteracy, etc."[120] Similarly, the UN's World Summit for Social Development defines poverty as the lack of basic amenities such as food, basic health, adequate housing, education; a secured social environment free from discrimination and exclusion; and the lack of participation in decision making and in civil, social and cultural life.[121] In addition to international development institutions, leading research institutions have also taken an "opportunity and capacity" approach to development. For example, the Centre for Governance of Knowledge and Development (CGKD) in Australia notes: "Development involves removing restrictions on the opportunities of individuals or

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[117] Martha C. Nussbaum, "Capabilities as Fundamental Entitlements: Sen and Social Justice", in Alexander Kaufman, ed., *Capabilities Equality: Basic Issues and Problems*, (New York: Routledge, 2006).
[118] Martha C. Nussbaum, "Human Capabilities, Female Human Beings," in Martha C. Nussbaum & Jonathan Glover, eds., *Women, Culture and Development* (Oxford: Clarendon, 1995) at 87; Nussbaum, *Women and Human Development, supra,* note 110 in chapter 3, at 74-75.
[119] According to Sen, "poverty must be seen as the deprivation of basic capabilities rather than mere lowness of income, which is the standard criterion of identification of poverty." See Amartya Sen, *Development as Freedom*, *supra*, note 89 at 87.
[120] UNHCHR, *Human Rights and Poverty Reduction – A Conceptual Framework*, (New York; Geneva, 2004) at 9.
[121] Report of the World Summit for Social Development, Copenhagen, Denmark, March 6-12, 1995, Annex II, at 41. Online: <http://www.un.org.documents/ga/conf166/aconf166-9.htm> (last visited June 30, 2010).

groups to pursue their goals, as well as increasing the capacities of individuals or groups to fulfill their goals."[122]

In international development agencies, the shift towards Sen's approach started with the World Bank's 1990 *World Development Report: Poverty* and continued with the United Nations Development Programme's annual *Human Development Report*.[123] The World Bank has been advocating Sen's capability approach in each of its *Human Development Reports* since the first in 1990. The first *Human Development Report 1990* defines human development as: "a process of enlarging people's choices. The most critical ones are to lead a long and healthy life, to be educated and to enjoy a decent standard of living. Additional choices include political freedom, guaranteed human rights and self-respect."[124] The *Human Development Report 2003* states:

> Human development is about people, about expanding their choices to live full, creative lives with freedom and dignity. Economic growth, increased trade and investment, technological advance—all are very important. But they are means, not ends. Fundamental to expanding human choices is building human capabilities: the range of things that people can be. The most basic capabilities for human development are living a long and healthy life, being educated, having a decent standard of living and enjoying political and civil freedoms to participate in the life of one's community.[125]

The *Human Development Report 2004* states: "[T]he basic purpose of development is to enlarge human freedoms. The process of development can expand human capabilities by

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[122] See online: The Centre for Governance of Knowledge and Development (CGKD) <http://cgkd.anu.edu.au> (last visited June 30, 2010).
[123] World Bank, *World Development Report 1990: Poverty,* (New York: Oxford University Press, 1990); United Nations Development Programme, *Human Development Report 1990: Concept and Measurement of Human Development*, (New York: Oxford University Press, 1990).
[124] UNDP, Human Development Report 1990: Concept and Measurement of Human Development, (New York: Oxford University Press, 1990) at 10.
[125] UNDP, Human Development Report 2003: Millennium Development Goals: A Compact Among Nations to End Human Poverty, (New York: UNDP, 2003) at 28.

expanding the choices that people have to live full and creative lives."[126] The *Human Development Report 2009* states: "Human development puts people at the centre of development. It is about realizing human potential, increasing choice and expanding the scope for people to lead the lives they value."[127]

Based on Sen's capability approach, the Human Development Index (HDI) has been used by the United Nations Development Programme (UNDP) since 1990 to measure the achievements of a country in the three basic dimensions of human development: a long and healthy life, as measured by life expectancy at birth; educational attainment, as measured by a combination of adult literacy and combined primary, secondary and tertiary school enrolment rate; and a decent standard of living, as measured by real per capita income, measured at purchasing power parity (expressed in United States dollars).

3.3.4 The Evaluation of Capability Approach and its Missing Innovation Dimension

Sen and Nussbaum have made great contributions to the intellectual framework for understanding development as a human right. Emerging scholars have also developed a large literature on the capability approach since the establishment of the Human Development and Capability Association (www.hd-ca.org). One of the strengths of Amartya Sen's capability approach lies in its broad agenda for multidisciplinary development research that is sufficiently inclusive to be fruitfully applied in the particular contexts of poverty and injustice. More specifically, by not subscribing to a definitive list of capabilities, Sen's capability approach has been praised for exhibiting internal pluralism and flexible

[126] World Bank, *Human Development Report 2004: Making Services Work for Poor People,* (Washington, D.C.: World Bank, 2003) at 127.
[127] UNDP, *Human Development Report 2009: Overcoming Barriers: Human Mobility and Development,* (New York: UNDP, 2009) online: <http://hdr.undp.org>.

applicability in different contexts, thereby allowing for the selection and weighting of capabilities according to personal value judgements.[128]

On the other hand, Sen's insistence on respecting personal values and aspirations by leaving open the choice and valuation of capabilities has attracted some critiques.[129] For example, David Clark argues that Sen's framework has difficulty "making interpersonal comparisons of well-being in the presence of potential disagreements about the valuation of capabilities including the relative weights to be assigned to those capabilities."[130] Similarly, Frances Stewart and Severine Deneulin argue that Sen's approach is an example of "methodological individualism," according to which "all social phenomena must be accounted for in terms of what individuals think, choose, and do."[131] Sen responded to this criticism by stating:

> The problem is not with listing important capabilities, but with insisting on one predetermined canonical list of capabilities, chosen by theorists without any general social discussion or public reasoning. To have such a fixed list, emanating entirely from pure theory, is to deny the possibility of fruitful public participation on what should be included and why … public discussion and reasoning can lead to a better understanding of the role, reach and significance of particular capabilities.…[132]

In my view, the capability approach omits the important role of innovation in human development. Apart from Nussbaum's fourth central human capability—"senses, imagination, and thought"—which touches upon intellectual freedom and innovation

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[128] Clark, "Capability Approach", *supra,* note 105 in chapter 3.
[129] John M. Alexander, *Capabilities and Social Justice: The Political Philosophy of Amartya Sen and Martha Nussbaum,* (Aldershot, England: Ashgate, 2008). See generally critiques of the Capability Approach, Flavio Comin, Mozaffar Qizilbash & Sabina Alkire, eds., *The Capability Approach: Concepts, Measures and Applications*, (Cambridge, UK: Cambridge University Press, 2008).
[130] Clark, "Capability Approach", *supra,* note 105 in chapter 3.
[131] Frances Stewart & Severine Deneulin, "Amartya Sen's Contribution to Development Thinking", (2002) 37 Studies in Comparative International Development 61 at 66.
[132] Amartya Sen, "Capabilities, Lists and Public Reason: Continuing the Conversation", (2004) 10:3 Feminist Economics at 77.

capability, the capability approach has not adequately accounted for the contribution of technology advancement and innovation in enlarging personal capabilities and equalizing distributive injustice. In the next section, I will discuss the missing dimension of innovation in the capability approach and argue that it can be greatly strengthened by perspectives and recent developments in intellectual property law and innovation studies.

3.3.5 Conclusion

The capability approach provides a new perspective for studying development as a comprehensive and evolving process of both individual and societal progress. Contrast with other approaches to development which focus exclusively on resources, or income, or utility to measure the quality of life or well-being, the capability approach reflects one's freedom or real opportunities. What people can positively achieve is influenced by a complex array of factors, including "economic opportunities, political liberties, social powers, and the enabling conditions of good health, basic education, and the encouragement and cultivation of socioeconomic initiatives."[133]

The capability approach to development shifts the focus of development thinking away from regulating state relations to promoting people's welfare: enabling them to realize their full potential; enlarging the substantive freedoms they enjoy; and enhancing their capabilities.[134] The objective of a multi-dimensional development process, the capability approach theorists posit, is to improve individual's lives through providing them with greater access to development resources such as primary health and education and enhancing their

[133] Jeffrey W. Cason & Sunder Ramaswamy, "An Introduction to the Debates", in Sunder Ramaswamy & Jeffrey W. Cason, eds., *Development and Democracy: New Perspectives on an Old Debate*, (London: University Press of New England, 2003) at 6.
[134] Paul L.C. Torremans, ed., *Intellectual Property and Human Rights*, 2d ed., (The Netherlands: Kluwer Law International, 2008).

life choices and development possibilities.[135] In short, humanistic concerns of well-being, such as environmental integrity,[136] access to knowledge, right to democracy,[137] and good governance, are integrated with the development objectives and measurement methods.

3.4 Proposing an Innovation Capability Approach to Development

This section adopts the conceptual framework of the capability approach to development and proposes an innovation capability approach which advocates for the idea that innovation capability is one of the fundamental capabilities for modern human beings to function in the knowledge economy and should be cultivated and promoted as such. Conceiving innovation capability from broad technological, institutional, cultural, and social dimensions, I argue that innovation capability is driven not only by technological development, but also by business model transformation, institutional change, norm-shifting in open and collaborative innovation culture, and social interactions in innovation networks. Furthermore, a "substantive equality of innovation capability" principle is needed for fairly distributing innovation resources, accessing innovation opportunities, and bridging the global innovation divide.

3.4.1 The Importance of Innovation Capability to Development

I argue that innovation can play a prominent role in both increasing people's standard of living and decreasing distributive inequality. In my view, the most important capability

[135] Martha C. Nussbaum & Amartya K. Sen, "Internal Criticism and Indian Rationalist Traditions", in Michael Krausz, ed., *Relativism, Interpretation and Confrontation,* (South Bend, IN: University of Notre Dame Press, 1989) at 299-325.
[136] Aaron Cosbey, "A Capabilities Approach to Trade and Sustainable Development: Using Sen's Conception of Development to Re-examine the Debates", (Winnipeg, Canada: International Institute for Sustainable Development, 2004).
[137] Thomas M. Franck, "The Emerging Right to Democratic Governance", (1992) 86 Am. J. Int'l L. 46.

one should possess in the knowledge society is the capability to learn. The capability to learn is fundamental for all other capabilities and it is the one that will shape the dynamics of innovation welfare. As Lundvall puts it, "economic development is about enhancing capability and opportunity to learn at all levels. Technological learning is fundamentally important but so is the social and political learning that is necessary to build institutions and policy strategies that support competence-building."[138]

The 2005 UN Millennium Project on Science, Technology and Innovation stresses that all eight MDGs depend on scientific capabilities and innovation.[139] Successive scientific and technological revolutions have introduced new products and services with a tremendous impact on well-being and general welfare. Yet innovation has not been available to all individuals and their societies. There are still countries in the developing world that lack access to fundamental innovations. For instance, today 1.6 billion people have no access to electricity, while the availability of medicines in several countries remains poor.[140] Unequal generation and diffusion of innovation constitutes a major problem of substantive inequality between developed and developing countries. It is reasonable to say that the dominant global

[138] Bengt-Åke Lundvall, et al., *Handbook on Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Context*, (Cheltenham, UK: Edward Elgar, 2009).
[139] "A nation's ability to solve problems and initiate and sustain economic growth depends partly on its capabilities in science, technology and innovation. Science and technology are linked to economic growth; scientific and technical capabilities determine the ability to provide clean water, good health care, adequate infrastructure and food. Development trends around the world need to be reviewed to evaluate the role that science, technology and innovation play in economic transformation in particular and sustainable development in general." Calestous Juma & Lee Yee-Cheong, *Innovation: Apply Knowledge in Development,* (London: Earthscan, 2005) at 20.
[140] David Birchall & George Tovstiga, *Capabilities for Strategic Advantage: Leading through Technological Innovation,* (New York: Palgrave Macmillan, 2005).

innovation path has contributed in important ways to the persistence of global poverty and to a widespread increase in global inequality.[141]

The last decade of the twentieth century marks the beginning of the economic globalization and information revolution that has clearly challenged fundamental norms in international law and international relations, economic growth and wealth creation, the way information-intensive knowledge products are produced and disseminated, and, in turn, how we innovate. The sharp acceleration in the pace of technological advancement and the speed with which information and innovation are disseminated has made innovation an important source of economic growth and human development.[142]

With the emergence of a networked knowledge economy, human capabilities and national welfare are critically dependent on the core inputs of technology, knowledge, and innovation.[143] First, economic growth depends on technological change and the increase and accumulation of technological and other knowledge that is of commercial value.[144] The "new growth theory", or "endogenous growth theory", which first emerged in 1956 following Robert Solow's seminal paper, asserts that technological change is the fundamental driving force in economic growth and the advancement of societies.[145] Solow observed that due to

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[141] Cristina Castelli, "Innovation", in Helge Hveem & Lelio Iapadre, eds., *The Global Governance of Knowledge Creation and Diffusion,* (London: Routledge, 2011) at 65; and Helge Hveem & Lelio Iapadre, "Global Governance of Knowledge Policies: Summary and Conclusions", in Helge Hveem & Lelio Iapadre, eds., *The Global Governance of Knowledge Creation and Diffusion,* (London: Routledge, 2011) at 183.

[142] "Growth studies of different kinds (empirical, theoretical) have rather unambiguously indicated the decisive role of technological and organizational development for economic growth on the macro level, in the form of different kinds of innovations." See Ove Granstrand, "Patents and Policies for Innovations and Entrepreneurship", in Toshiko Takenaka, eds., *Patent Law and Theory: A Handbook of Contemporary Research*, (Cheltenham, UK: Edward Elgar, 2009) at 69.

[143] Yochai Benkler, *Wealth of Networks*, *supra,* note 15 in chapter 1, at 302.

[144] Gene M. Grossman & Elhanan Helpman, "Endogenous Innovation in the Theory of Growth", (1994) 8:1 Journal of Economic Perspectives 23, at 26-7.

[145] Robert M. Solow, "A Contribution to the Theory of Economic Growth", (1956) 70:1 Quarterly Journal of Economics 65. Other economists have also confirmed the significant contribution of technological progress to

decreasing returns to physical capital—eventually more machines are not that useful—technological change must be the key source of economic growth.[146] Solow demonstrates that technological change, rather than increases in physical capital and labor, accounts for most of the economic growth and improvements in economic well-being.[147] Statistically, Solow showed that about 87.5% of the economic growth occurring in the United States between 1909 and 1949 was due to technological change.[148] Paul Romer, a pioneer of the new growth school, believed that knowledge itself has intrinsic economic value.[149] Romer posited that ideas, as embodied in new technologies, are a factor of economic production in addition to the three classic factors—capital, labor, and natural resources.[150] Similarly, Paul Samuelson and William Nordhaus argue that in addition to the three classic factors, economic growth depends on a vital fourth factor, technology.[151] In short, the key to economic growth is technological change.

Second, the wealth of nations has shifted from its initial base on agricultural output and mining, subsequently to automated machinery goods, and then to advantages in science and technology. In arguing for strong intellectual property protection, Alan Greenspan

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economic growth. See, e.g., Thomas L. Beane, ed., *Economics of Technological Change*, (New York: Nova Science, 2007); Frederic M. Scherer, *New Perspectives on Economic Growth and Technological Innovation*, (Washington, D.C.: Brookings Institution, 1999); OECD, *Innovation and Growth: Rationale for an Innovation Strategy*, (Paris: OECD, 2007); James Duesenberry, "Innovation and Growth", (1956) 46:2 American Economic Review 134.

[146] Robert M. Solow, "A Contribution to the Theory of Economic Growth", (1956) 70:1 Quarterly Journal of Economics 65.

[147] Robert M. Solow, "Technical Change and the Aggregate Production Function", (1957) 39:3 Review of Economics and Statistics 312 at 320.

[148] *Ibid*.

[149] Paul Romer, "Endogenous Technological Change", (1990) 98:5 Journal of Political Economy S71-S102; Robert E. Lucas, "On the Mechanics of Economic Development", (1988) 22:1 Journal of Monetary Economics 3-42.

[150] Paul Romer, "The Origins of Endogenous Growth", (1994) 8 Journal of Economic Perspectives 3-22; and Elhanan Helpman, "Endogenous Macroeconomic Growth Theory", (1992) 36 European Economic Review 237-267.

[151] Paul A. Samuelson & William D. Nordhaus, *Macroeconomics* 15ed., (New York: McGraw-Hill, 1995) at 208.

acknowledges "[t]his shift of emphasis from physical materials to ideas as the core of value creation appears to have accelerated in recent decades."[152] Ideas, or knowledge, as an important component of intellectual capital has become a much more valuable resource in the global competition than traditional monetary or physical capital.[153] There are lots of companies in the knowledge-economy whose biggest (if not the only) value is based on intellectual property, e.g. Coke's formula or Google's algorithm. It has been estimated that three-quarters of the value of public companies in the United States comes from intangible assets, almost twice as much as in the early 1980s.[154] Nine of the Forbes's top 10 Billionaires 2012 are in intellectual property intensive industries such as technology, telecommunication, fashion, and investment; while only one is in the traditional oil and mining industry.[155] As Francis Gurry states, "[t]he source of wealth creation in the knowledge economy has shifted increasingly away from physical capital towards intellectual capital and, just as physical property controls physical capital, so intellectual property controls the source of wealth creation that is represented by intellectual capital."[156] In short,

[152] Alan Greenspan, "Market Economies and Rule of Law", Speech made at the 2003 Financial Markets Conference of the Federal Reserve Bank of Atlanta on April 4 2003, Sea Island, Georgia (via satellite), online: The Federal Reserve Board, <http://www.federalreserve.gov/BoardDocs/Speeches/2003/20030404/default.htm>. "Over the past half century, the increase in the value of raw materials has accounted for only a fraction of the overall growth of U.S. gross domestic product. The rest of that growth reflects the embodiment of ideas in products and services that consumers value."

[153] An article in *The Economist* states that: "Modern economies are not built with capital or labour as much as by ideas. Nearly half of America's gross domestic product is based on intellectual property, one estimate found." See "Intellectual Property: New Ideas about New Ideas", *The Economist* (9 December 2006), online: The Economist <http://www.economist.com/world/international/displaystory.cfm?story_id=8382648>.

[154] Intangible assets represent the major share of stock market value (estimated at around two thirds in the US) and more than half of total investment is devoted to intangibles. See Robert C. Bird & Subhash C. Jain, eds., *The Global Challenge of Intellectual Property Rights* (Cheltenham, UK: Edward Elgar, 2008) at 19.

[155] Forbes, "The World's Billionaires", available online: <http://www.forbes.com/billionaires/>.

[156] Francis Gurry, "The Growing Complexity of International Policy in Intellectual Property", (2005) 11:1 Science and Engineering Ethics 13 at 16.

acquisition of knowledge is "an important dimension of human development because it is a critical means of building human capability."[157]

As a result of the above two trends, innovation capability has become the definitive element of competitiveness to an individual, an enterprise, and a nation. To individuals, innovation capability refers to the capability of individuals to choose the best way to deploy their intellectual resources with a view to producing the optimal outcome with given physical and financial capabilities. To enterprises, Joseph Schumpeter suggested that novelty is the distinguishing attribute of entrepreneurship and innovation is the driving engine that creatively destructs capitalist production processes.[158] To nations, innovation capabilities refer to capabilities of a nation to structure its social relations and streamline production processes in order to build an efficient information platform and innovation infrastructure

To conclude, information and knowledge are key development resources and the capability to learn, to exploit information in social production, and to disseminate knowledge for sustainable innovation is a key capability for modern human beings to function in the knowledge economy. Innovation capability at all levels is critically important to foster indigenous innovation while promoting individuals' freedom to innovate. In essence, harnessing people's brainpower, benefiting from science, technological progress and business process innovation, and cultivating innovation capability of the country as a whole are important to shape the economic landscape and gain global competitiveness.

[157] United Nations Development Program, *Arab Human Development Report 2002: Creating Opportunities to Future Generation,* (New York: UNDP, 2002) at 19.
[158] *Supra,* note 1 in chapter 2.

3.4.2 Innovation Capability and its Relationship to Capability Approach

How does innovation capability, as a key driver of technological, economic, cultural and social development, relate to the capabilities that Sen and Nussbaum have discussed? This section aims to examine what innovation capability entails and its relationship to the capability approach.

Sen sees capability as a genuine opportunity to pursue valuable functionings. I see innovation capability as the freedom to achieve the basic level of knowledge and skills to function (earn a dignified living) in the knowledge society and to exercise intellect in ways that one chooses. Innovation capability is a substantive freedom to access foundational knowledge in the innovation commons and transform existing knowledge into innovations. In essence, innovation capability is about the real opportunity one has to develop her knowledge base and exercise her intellectual skills so that she can create and extract value from her innovative ideas. The core focus of the innovation capability approach is on the substantive freedoms that individuals have to (1) access and build on the foundational knowledge and information in the innovation commons; and (2) develop and exercise their intellectual skills in the adaptation and transformation of innovative ideas into real values that both fulfill their aspirations and contribute to social welfare.

The traditional capability approach addresses such dimensions of human development as life (health, nutrition, and security), basic liberties (freedom of movement and freedom of association), environmental integrity (harmony with the natural world), employment (freedom of occupational choice), spirituality (freedom of religion), and participation. The innovation capability approach adds critically important dimensions to

human development, such as access to knowledge, developing and cultivating intellectual potential, participation in innovative activities, and unleashing entrepreneurial spirit. In particular, innovation capability approach enables intrinsic and instrumental freedoms of research, information and knowledge sharing, competition, conservation, transfer of technology, differentiation, entrepreneurial initiatives and new ventures, dissemination, and collaboration.

Innovation comes in different forms and degrees: some are technological, whereas others are commercial or social; some are simple improvements or adaptations, whereas others are radically original. Innovation capabilities are decentralized and widely represented in (1) science and technology; (2) business management; and (3) legal and policy responses to underdevelopment. In general, there are three main forms of innovation capability: technological, commercial, and social.[159]

Technological innovation capability is the capability to solve technological problems in the physical world through the accumulation of scientific and technical knowledge. Technological innovation includes not only the creation and improvement of new technologies, but also the dissemination, application, and adaptation of existing technologies in a new context.[160] In other words, technological innovation does not necessarily mean technological sophistication; it can also include applying scientific information and adapting

[159] This categorization is inspired by Thomas Homer-Dixon, who divides ingenuity into technical and social: the type of ingenuity used to create new technologies and solve problems in the physical world is technical ingenuity; and the type of ingenuity "used to reform old institutions and social arrangements and build new ones" is social ingenuity. See Thomas Homer-Dixon, *The Ingenuity Gap*, (New York: Alfred A. Knopf, 2000).
[160] "The ability to adapt, therefore, is a significant step in technological empowerment, which over a period of time, can lead to the creation of knowledge generation capabilities amongst actors that are demand-driven rather than simply those that aim to replicate the successes of other regions of the world." UNCTAD, *Technology and Innovation Report 2010: Enhancing Food Security in Africa through Science, Technology and Innovation*, UN Doc. UNCTAD/TIR/2009, online: <http://www.unctad.org/en/docs/tir2009_en.pdf>. (last visited 19 December 2012).

technologies to suit the local context, which is particularly important to developing countries.[161] Given the fact that developing countries undertake relatively less formal innovative activities (e.g., R&D) than developed countries, the capability to adopt and adapt existing technologies to their specific local context is the primary way by which technological innovation improves their economic growth and welfare.[162] In order to facilitate technology absorption and innovation capability building, every country needs a specifically designed innovation system.[163]

Commercial innovation capability is the capability to solve entrepreneurial problems in the marketplace through business model transformation and organizational change. New business models are critical to opening up new markets and increasing profit margins in the process of introducing technological innovations into a new commercial context. Further, organizational changes induced by technological adaptation and incremental innovation may significantly increase productivity.[164] Similarly, Joseph Schumpeter recognizes that the organizational and societal context in which technological innovations occur is important for transforming technological advancement to commercial gains. After all, technological innovation is to help businesses gain competitive advantage by serving their consumers' needs better. Innovative products might not be those with high quality or novel designs, but those most suitable to a particular market. For example, cost reduction in the context of process development might prove to be more valuable commercially than a giant leap forward in technological improvement.

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[161] *Supra,* note 9 in chapter 2.
[162] *Supra,* note 10 in chapter 2.
[163] *Supra,* note 11 in chapter 2.
[164] Jan Fagerberg, "Innovation: A Guide to the Literature" in Jan Fagerberg, David C. Mowery & Richard R. Nelson, eds., *The Oxford Handbook of Innovation*, (Oxford: Oxford University Press, 2006) at 8. [Fagerberg, *Oxford Handbook of Innovation*]

Social innovation capability is the capability to solve social problems through institutional reforms and relational building. The essence of the notion of "social innovation" is linked to the development, adoption, and implementation of new strategies, techniques, ideas and/or organizational structures to meet a host of diverse social needs.[165] Homer-Dixon contends that "technological ideas are not the only productive ideas; just as important are ideas about social organization, especially about reforming and building institutions."[166] Therefore, social innovation is essential to formulate novel legal and policy responses to underdevelopment in order to distribute the social benefits of technological and commercial innovation more equitably.

To conclude, innovation capability is essential for anyone to participate in the process of knowledge creation and expand her social, cultural, and economic freedoms.[167] An innovation capability approach goes beyond inducing technological innovations and accounts for promoting intellectual growth and autonomous experience of self-actualization, while preserving the space for equal opportunity to innovate and innovation freedom in the global knowledge economy.[168] In order to achieve these goals, a substantive equality of innovation capability principle is proposed and elaborated in the following subsection.

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[165] Diana MacCallum, *et al*., "Introduction", in Diana MacCallum, *et al*., eds., *Social Innovation and Territorial Development*, (Aldershot: Ashgate, 2008) at 1-8; James A. Phills Jr., Kriss Deiglmeier, & Dale. T. Miller, "Rediscovering Social Innovation", (Fall 2008) Stanford Social Innovation Review, online: <http://www.ssireview.org/images/articles/2008FA_feature_phills_deiglmeier_miller.pdf> (last visited August 30, 2012); and O Neuloh, "Social Innovation: History, Theory, Internationalization", in C.G. Hedén & A. King, eds., *Social Innovations for Development*, (Oxford: Pergamon Press, 1984).

[166] Thomas Homer-Dixon, "The Ingenuity Gap: Can Poor Countries Adapt to Resource Scarcity?" (1995) 21(3) Population and Development Review, 587-612, online: <http://www.library.utoronto.ca/pcs/ingen/ingen.htm> (last visited August 30, 2012).

[167] Sunder, "IP and Development as Freedom", in Neil Weinstock Netanel, ed., *The Development Agenda: Global Intellectual Property and Developing Countries*, (New York: Oxford University Press, 2009) at 470.

[168] As a UN report puts it, "At its best, the Knowledge Society involves all members of a community in knowledge creation and utilization. [It] is not only about technological innovations, but also about human beings, their personal growth, and their individual creativity, experience and participation." See United

3.5 Substantive Equality of Innovation Capability Principle

As I have touched upon in section 3.2.2, there are two general ways in which the principle of equality has been interpreted in law: the like-treatment model (formal equality) and the equality of outcome model (substantive equality).[169] The like-treatment model represents a minimal notion of equality and can be best described by the Aristotelian notion of "treating equals equally and unequals unequally."[170] It requires formal neutrality in the application and enforcement of laws. It assumes that identical treatment will always result in equality. This assumption would be appropriate if individuals were similarly situated, but could result in *de facto* discrimination when people have demonstrable privilege.[171] As pointed out by G. Quinn, formal equality fails to recognize that social injustice "resides in the structures (built to reflect and accommodate privileged norms) and not in the person who is judged different."[172]

Substantive equality, however, requires a critical examination of the social context and the actual oppression and subordination faced by different people.[173] It involves a careful

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Nations, Understanding Knowledge Societies: In Twenty questions and answers with the Index of Knowledge Societies, ST/ESA/PAD/SER.E/66, (New York: United Nations, 2005) at 150.

[169] The "substantive equality" or "equality of outcome" model is advocated in Robert M. Veatch, *The Foundations of Justice: Why the Retarded and the Rest of Us Have Claims to Equality*, (New York: Oxford University Press, 1986); John Rawls, "Justice as Fairness", (1958) 67 The Philosophical Review 162-194; C. Edwin Baker, "Outcome Equality or Equality of Respect: The Substantive Content of Equal Protection," (1983) 131 U. Pa. L. Rev. 933.

[170] See Aristotle, *Ethics*, Book III, (London: Dent, 1963), translated by John Warrington; James P. Sterba, *The Demands of Justice*, (Notre Dame: University of Notre Dame Press, 1980).

[171] Marcia H. Rioux & Christopher A. Riddle, "Values in Disability Policy and Law: Equality", in Marcia H. Rioux, Lee Ann Basser, & Melinda Jones, eds., *Critical Perspectives on Human Rights and Disability Law*, (Leiden: Martinus Nijhoff, 2011) 37 at 42.

[172] See G. Quinn, "The International Covenant on Civil and Political Rights and Disability: a Conceptual Framework", in Theresia Degener & Yolan Koster-Dreese, *Human Rights and Disabled Persons: Essays and Relevant Human Rights Instruments,* (Dordrecht: Martinus Nijhoff, 1995).

[173] Kelley Loper, "Substantive Equality in International Human Rights Law and its Relevance for the Resolution of Tibetan Autonomy Claims", (2012) 37 N. C. J. Int'l L. & Com. Reg. 1 at 10.

analysis of "how difference is recognized, given meaning, and valued."[174] Substantive equality differs from formal equality in three aspects: "First, substantive equality requires equality of results, and not simply equality of opportunity. Second, substantive equality recognizes that differential treatment may be required to achieve equality of results. Finally, substantive equality often requires enabling conditions or special measures."[175]

To summarize, formal equality has "failed to eliminate entrenched structural social and economic inequality and that a different approach is required in order to tackle the roots of inequality and achieve substantive equality."[176] Accordingly, substantive equality may be required to provide differential treatment of people in proportion to their unlikeness under circumstances where formal equality may lead to discriminatory results.[177]

The substantive equality principle is a well-developed doctrine which is inclusive and flexible enough to be applied in different fields of inquiries at both national and international levels. The substantive equality principle is often applied in national constitutional law and

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[174] Marcia H. Rioux & Christopher A. Riddle, "Values in Disability Policy and Law: Equality", in Marcia H. Rioux, Lee Ann Basser, & Melinda Jones, eds., *Critical Perspectives on Human Rights and Disability Law*, (Leiden: Martinus Nijhoff, 2011) at 37-55.

[175] Marianne Schulze & Kirsten Young, "Respect for Difference: a Value or a Value-Add to Discrimination and Equaltiy Norms", (2008) 1 Juridikum 45 at 47.

[176] Evadné Grant, "Dignity and Equality," (2007) 7:2 Human Rights Law Review at 299-329.

[177] Justice McLachlin wrote that "the essential meaning of the constitutional requirement of equal protection and equal benefit is that persons who are 'similarly situated be similarly treated' and conversely, that persons who are 'differently situated be differently treated'". See *Law Society of British Columbia v. Andrews*, [1989] 1 S.C.R. 143 at para. 22. There are three principles in the conceptualization of equality: the similarly situated, anti-discrimination, and group-disadvantaging principles. See Owen M. Fiss, "Groups and the Equal Protection Clause", (1976) 5 Philosophy and Public Affairs 107. [Fiss, "Groups and the Equal Protection Clause"] Jack M. Balkin and Reva B. Siegel updated Fiss's terminology, referring to the separate but equal, anti-classification, and anti-subordination principles. See Jack M. Balkin & Reva B. Siegel, "The American Civil Rights Tradition: Anticlassification or Antisubordination?" in Robert Post, ed., *The Origins and Fact of Antisubordination Theory: A Symposium on Owen Fiss's "Groups and the Equal Protection Clause"*, online: Social Science Research Network <http://papers.ssrn.com/abstract=380800>. See also, Beverley Baines, "Is Substantive Equality a Constitutional Doctrine?" at 67, online: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1028944>; Beverley Baines & Ruth Rubio-Marin, "Introduction," in Beverley Baines & Ruth Rubio-Marin, eds., *The Gender of Constitutional Jurisprudence* (Cambridge: Cambridge University Press, 2005) at 13-14.

human rights law. For example, the United States equality law encompasses the similarly situated, anti-discrimination, dignity, and group-disadvantaging principles.[178] Similarly, a vision of promoting substantive equality is enshrined in section 15 of the *Canadian Charter of Rights and Freedoms 1982*.[179]

Furthermore, the substantive equality principle has been widely applied in international trade,[180] development,[181] copyright,[182] and information privacy.[183] According to Margaret Chon, a substantive equality principle is "a necessary corollary to the formal equality principles of national treatment and minimum standards that are now imposed on virtually all countries regardless of their level of development."[184] In WTO terms, the non-discrimination principle is based on formal equality and prohibits countries from discriminating between their trading partners or between imported and locally-produced

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[178] See Owen M. Fiss, "Groups and the Equal Protection Clause," (1976) 5 Philosophy and Public Affairs 107. Jack M. Balkin and Reva B. Siegel updated Fiss's terminology, referring to the separate but equal, anti-classification, and anti-subordination principles. See Jack M. Balkin & Reva B. Siegel, "The American Civil Rights Tradition: Anticlassification or Antisubordination?" in Robert Post, ed., *The Origins and Fact of Antisubordination Theory: A Symposium on Owen Fiss's "Groups and the Equal Protection Clause"*, online: Social Science Research Network <http://papers.ssrn.com/abstract=380800>.

[179] *Canadian Charter of Rights and Freedoms*, Part I of the *Constitution Act, 1982*, being Schedule B to the *Canada Act 1982* (U.K.), 1982, c. 11. Commentators have argued that substantive equality in Canadian jurisprudence has four principle features: (i) the contextualization of equality claims; (ii) the equality of results or outcome; (iii) a challenge to oppression or subordination; and (iv) the fact that it is group oriented. See Beverly Baines "Is Substantive Equality a Constitutional Doctrine" in Y. Gendreau, ed., *La doctrine et le developpement du droit/Developing Law with Doctrine*, (Montreal: Les Éditions Themis, 2005) 59 at 79. See also, Beverley Baines & Ruth Rubio-Marin, "Introduction", in Beverley Baines & Ruth Rubio-Marin, eds., *The Gender of Constitutional Jurisprudence*, (Cambridge: Cambridge University Press, 2005) at 13-14; and Emily Grabham, "*Law v. Canada*: New Directions for Equality under the Canadian Charter?" (2002) 22 Oxford Journal of Legal Studies, at 641-661.

[180] Gillian Moon, "Trade and Equality: A Relationship to Discover", (2009) Journal of International Economic Law 1-26.

[181] See Margaret Chon, "Intellectual Property and the Development Divide", *supra,* note 25 in chapter 1, at 2823; see also, Madhavi Sunder, "Intellectual Property and Development as Freedom," *supra,* note 25 in chapter 1.

[182] Wendy J. Gordon, "A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property", (1993) 102 Yale L.J. 1533.

[183] Julie E. Cohen, *Configuring the Networked Self, supra,* note 24 in chapter 1.

[184] See Margaret Chon, "Intellectual Property and the Development Divide", *supra,* note 25 in chapter 1; see also, Margaret Chon, "Substantive Equality in International Intellectual Property Norm-Setting", *supra,* note 25 in chapter 1.

goods, known respectively as the "Most-Favoured-Nation" treatment and "National" treatment.[185] In the context of trade in intellectual property, the non-discrimination principle provides equal treatment of intellectual property rights holders. TRIPS Article 3 provides that intellectual property protection and enforcement shall be non-discriminatory as to the nationality of rights holders.[186] TRIPS Article 4 provides that a Member shall treat nationals of different Members alike with respect to intellectual property protection.[187]

Margaret Chon suggests that a substantive equality principle is needed in global intellectual property rule-making and norm-setting to facilitate access to essential information goods.[188] The substantive equality principle takes into account not only the economic and utilitarian impacts of intellectual property, but also the distributional effects on human well-being. Chon maintains that the principle of substantive equality would take the form of an extra "thumb on the scale" of scepticism towards the enforcement of minimum rights expressed in multilateral or bilateral conventions as they pertain to certain types of development-sensitive categories.[189] The objective of a substantive equality principle is to "transform [...] the relatively crude binary intellectual property balancing test

[185] Analytical Study of the High Commissioner for Human Rights on the Fundamental Principle of Non-Discrimination in the Context of Globalization, UN Doc E/CN.4/2004/40, available online: UN <http://daccess-dds-ny.un.org/doc/UNDOC/GEN/G04/103/57/PDF/G0410357.pdf?OpenElement> at para 25.
[186] The National Treatment requires that "[e]ach Member shall accord to the nationals of other Members treatment no less favourable than it accords to its own nationals with regard to the protection of intellectual property.…" TRIPS Article 3.
[187] The Most Favoured Nation (MFN) treatment requires that "[w]ith regard to the protection of intellectual property, any advantage, favour, privilege or immunity granted by a Member to the nationals of any other country shall be accorded immediately and unconditionally to the nationals of all other Members" with limited exceptions. TRIPS Article 4.
[188] Margaret Chon, "Intellectual Property and Development Divide," *supra,* note 25 in chapter 1, at 2886.
[189] Chon, "Copyright and Capability for Education", *supra,* note 49 in chapter 2.

into a more nuanced and context-sensitive discourse about the instrumental purpose of intellectual property."[190]

Julie Cohen emphasizes the significance of substantive equality in rule- and policy-making:

> The capabilities approach … defines freedom in terms of the development of affirmative capabilities for flourishing. Thus defined, freedom is not simply a function of the absence of restraint (or negative liberty), but also depends critically on access to resources and on the availability of a sufficient variety of real opportunities. Because of those requirements, moreover, freedom and equality are integrally connected within the capabilities approach. Equality is not simply a matter of making distributive adjustments here and there once the basic structure of entitlements is decided according to some other set of criteria. Substantive equality is a fundamental concern, and a normative constraint on both rule structures and policy recommendations.[191]

In this section, I aim to contribute to the debate by proposing a substantive equality of innovation capability principle. Applying a substantive equality principle to innovation capability may, at first, appear unorthodox due to their divergences in theoretical and normative justifications.[192] But it is the common goal they share—the full realization of each person's humanity—that makes this exercise not only possible, but also fruitful.

A substantive equality of innovation capability principle stipulates that people with different intellectual endowment, knowledge-access privilege, and innovation capability should be treated differently. I argue for a vision of substantive equality which is consistent with human rights principles and aims to achieve the following three objectives: (1) to

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[190] Margaret Chon, "Intellectual Property and the Development Divide", *supra,* note 25 in chapter 1, at 2839.
[191] Julie E. Cohen, *Configuring the Networked Self, supra,* note 24 in chapter 1, at 22.
[192] A substantive equality principle has its philosophical foundation in the natural law theory which upholds equal dignity of each human being as a matter of an inherent human right. See Richard W. Wright, "The Principles of Justice", (2000) 75 Notre Dame Law Review 1859. In contrast, proprietary- and market-based innovation systems are usually constructed on the basis of aggregate social welfare theories such as utilitarianism or economic efficiency.

promote respect for the equal dignity and worth of all; (2) to accommodate disadvantaged groups; and (3) to facilitate democratic participation in an innovation-based knowledge society. The full realization of these objectives requires more than negative duties of restraint, but may require positive duties, special measures, and other forms of adaptation and accommodation.[193]

In addition, drawing upon perspectives from the equality rights jurisprudence and international human rights literature, I argue that there are five underpinning elements in the conceptualization of substantive equality of innovation capability: equality of innovation opportunity, neutrality of innovation models, accessibility of the innovation commons, dignity of the entrepreneurial spirit, and respect for indigenous innovation. I will now examine each one in order.

3.5.1 Equality of Innovation Opportunity

Equality of innovation opportunity requires that persons of equal innovation capability and of equal willingness to use their innovation capability should have equal opportunities to compete for innovation resources.[194] The goal of ensuring equal innovation opportunity is to provide a fair playing field for everyone to acquire basic innovation capability and become reasonably functional members of the knowledge society. It requires

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[193] Sandra Fredman, *Human Rights Transformed: Positive Rights and Positive Duties,* (Oxford: Oxford University Press, 2008) at 179; see also, Sandra Fredman, "Disability Equality: A Challenge to the Existing Anti-Discrimination Paradigm?" in Anna Lawson & Caroline Gooding, eds., *Disability Rights in Europe: From Theory to Practice,* (Oxford: Hart, 2005).

[194] See general discussion on "equality of opportunity" in Richard Arneson, "Equality of Opportunity", Edward N. Zalta, ed., *The Stanford Encyclopedia of Philosophy*, available online: <http://plato.stanford.edu/entries/equal-opportunity/>. See also, Samuel Freeman, *Justice and the Social Contract: Essays on Rawlsian Political Philosophy*, (New York: Oxford University Press, 2007). See also, Daniel Butt, "Global Equality of Opportunity as an Institutional Standard of Distributive Justice", in Chios Carmody, Frank J. Garcia, & John Linarelli, eds., *Global Justice and International Economic Law: Opportunities and Prospects*, (Cambridge: Cambridge University Press, 2012) 44 at 49.

not only the elimination of discrimination, but also positive efforts to ameliorate opportunity-limiting social factors, such as inadequate transportation or communication infrastructure, poor access to basic medicine, and lack of education. These social factors may have profound negative impacts for people's ability to freely pursue their innovative ideas.

Equality of innovation opportunity provides a normative justification and entitlement for the enablement and equalization of innovation capability. As Amartya Sen argues, justice is served when equal opportunities are granted to individuals and their capabilities are equalized.[195] A just innovation system should provide existing and potential innovators with equal opportunities to innovate by removing the barriers facing them to exercise their intellectual. In addition, a just innovation system should also accommodate the needs of the disadvantaged (particularly those with lesser innovation capability) so that their innovation capabilities can be equalized.

Having access to the fundamental innovation resources and being able to act upon one's innovative ideas and participate in the knowledge society are prerequisites of ensuring equal innovation opportunity. It should be noted that this does not imply the right to access proprietary knowledge and information without reasonable financial compensation. Only those services that are effective at helping individuals become reasonably functional in a knowledge society by providing them with a basic level of innovation capability and freedom should be publicly-funded.

[195] Amartya Kumar Sen, *Rationality and Freedom, supra,* note, 97 in chapter 3; see also, Flavio Comim, Mozaffar Qizilbash, & Sabina Alkire, eds., *The Capability Approach: Concepts, Measures and Applications*, (Cambridge: Cambridge University Press, 2008).

3.5.2 Neutrality of Innovation Models

Patents are only one piece of a broader system of innovation. As I have alluded to in section 2.3.1, as alternatives to patent-incentivized innovation system, non-proprietary innovation systems rely on incentives from government support, commons and open source systems to innovate. An optimal system of innovation ought to be based on a complementary combination of proprietary and non-proprietary systems in order to produce the highest attainable rates of innovation, productivity, and social utility.

Innovation models are increasingly intertwined. The law of innovation and entrepreneurship is the legal mechanism to balance the various innovative components to a desirable ratio. My hypothesis is that the balance between the two systems has been tilting towards the patent system, thus generating an imbalance between the two types of innovation incentives. To offset this imbalanced patent regime, I propose "neutrality of innovation models" as the basis for an optimal innovation system. I argue that innovators should have the freedom to determine how to allocate their innovation resources between different innovation models. This requires that the government should remain neutral towards different innovation models.

The neutrality of innovation model does not imply that the government should put in place an innovation system that treats patent-based innovation model and non-proprietary innovation models with no difference. It represents a position of disengagement of picking and choosing the modes and directions of innovation resource flow on the part of the government. The government and the innovation system it sets up should not take part in a consideration or an evaluation of a desirable method to direct innovators how to exercise

their intellect in innovation production or make one compensatory mechanism more attractive to innovators than another. In other words, innovators have better information and are generally more motivated to acquire better information than the government in allocating and mobilizing innovation resources to produce higher productivity and social utility.[196] Therefore, the government should refrain from directing innovation resource flow towards a certain type of innovation model (most likely this innovation model is patent) by making it more attractive to innovators in terms of its accessibility, compensatory scheme, maintanence costs etc. The government's role is to encourage the disclosure of new technology (e.g., through the patent system), enlarge the innovation commons, promote information exchange and circulation, coordinate interactions between and among diverse innovative entities, and establish linkages, networks, and platforms for innovation collaboration.

3.5.3 Accessibility of Innovation Commons

As I have shown in section 2.3.3, innovation, as a cumulative process, is both an output of an innovation market and an input to generate more innovation. Even the most revolutionary innovations are based to some degree on prior knowledge. In addition, innovation is not a zero-sum game: one's innovation gain does not lead to another's loss. Due to the spillover effects and positive externalities produced by innovation, collaboration and collegial benefit-sharing add value on the existing innovation and provide more opportunities for future innovation. What is essential for innovation-based economic development in a networked knowledge society is the ability to establish linkages between

[196] Brian D. Wright, "The Economics of Invention Incentives: Patents, Prizes, and Research Contracts", (1983) 73:4 American Economic Review 691 at 695 (pointing out information asymmetry between the public research authority or administrator and the innovating agents).

the nodes (people, ideas, technological standards) in the network. For these reasons, a vibrant and accessible innovation commons is an important condition for cultivating innovation capability and securing the freedom to innovate. It should be noted that accessibility requires not only allowing access to innovation resources in the public domain, but also promoting the sustainable development of the innovation commons.

An innovation commons is a public place where everyone can build upon others' ideas and contribute her own. Lawrence Lessig discusses the evolution of an innovation commons through the internet and its physical (e.g., wires), logical (e.g., networking protocols and web standards TCP/IP), and content layers (e.g., applications).[197] He states: "An innovation commons is a place where everyone is equally allowed to innovate. The resource held in common is the right to innovate for this particular platform."[198] A dynamic innovation infrastructure that can facilitate the effective communication, dissemination, and processing of information is critical to build an accessible innovation commons.

Maintaining the openness and accessibility of a vibrant innovation commons involves both substantive and procedural components. The substantive component of maintaining the openness and accessibility of a vibrant innovation commons requires the relaxation of exclusive control over the ever-expanding scope of property rights in intellectual production. This can be achieved through a rebalance of proprietary (e.g., patent) and non-proprietary (e.g., government-backed innovation, commons, and open source) models of innovation. The existing innovation systems largely rely on proprietary interests to

[197] Lawrence Lessig, "The Tragedy of the Innovation Commons: Reconciling Private Claims with Public Interest", (2009) 4 J.L. Phil. & Culture 35. See also, Lawrence Lessig, "Internet under Siege", (2001) Foreign Policy Nov.-Dev., at 56-65.
[198] *Ibid*., at 36; see also, Lawrence Lessig, *The Future of Ideas: The Fate of the Commons in a Connected World*, (New York: Random House, 2001) at 23-25.

incentivize innovation and ignore the potential of alternative innovation systems to augment or even outperform proprietary models of innovation.

The procedural component of maintaining the openness and accessibility of a vibrant innovation commons mandates the strengthening of democratic principles such as transparency and participation in the making of national and international intellectual property law and innovation regulation. An open and access international intellectual property lawmaking process would denounce closed door treaty negotiations such as the Anti-Counterfeiting Trade Agreement.

The desirability or even necessity of maintaining the openness and accessibility of a vibrant innovation commons is two-fold. First, TRIPS—the most important international intellectual property instrument—was concluded before the Internet became ubiquitous, embedded, and animated, which enabled a panoply of new innovation modes and challenged the traditional proprietary innovation model. As a result, the limitations and exceptions, as well as built-in flexibilities, of TRIPS are inherently inadequate to accommodate open innovation. Second, global intellectual property law and policy have gained greater breadth and complexity and are inextricably intertwined with issues of fundamental significance such as health, education, and environment. The Western dominant intellectual property lawmaking threatens human survival and prosperity in under-represented societies and endangers the legitimacy and effectiveness of the international IP system itself.[199]

[199] See critiques of the global intellectual property regime, Adelbambo Adewopo, "The Global Intellectual Property System and Sub-Saharan Africa: A Prognostic Reflection", (2002) 33 U. Tol. L. Rev. 749 at 749-50; Olufunmilayo B. Arewa, "TRIPS and Traditional Knowledge: Local Communities, Local Knowledge, and Global Intellectual Property Frameworks", (2006) 10 Marq. Intell. Prop. L. Rev. 155, at 160-63.

3.5.4 Dignity of Entrepreneurial Spirit

Entrepreneurial spirit is a deeply embedded human trait and constitutes part of the "self". Entrepreneurial spirit can be empowered or restricted by the social and cultural environment as well as legal and regulatory framework found in different societies. Take the attitude towards risk and failure for example. A society that encourages risk-taking and accepts honest failure tends to bring about more entreprenurship.

Human dignity is a core constitutional value which has been incorporated into the substantive equality principle, particularly in the jurisprudence of the Canadian Supreme Court, German Constitutional Court, and South African Constitutional Court.[200] Human dignity requires individuals to be treated in a manner that respects their autonomy, self-respect, and equality of status. The dignity-based approach to entrepreneurial spirit allows the principle of respecting for human dignity to be applied to entrepreneurial spirit. In addition, it provides a framework within which the actual experience of seeding innovation and bringing an innovation to the market via entrepreneurship can be explored.

3.5.5 Respect for Indigenous Innovation

The principle of "respect for indigenous innovation" is to attribute innovation to its credible source and recognize the appropriability of innovation originating from indigenous

[200] "In seeking to implement an approach to equality that addresses the history of apartheid and the social and economic inequality endemic in South African society, the South African Constitutional Court has rejected formal equality, and is in the process of developing a substantive interpretation of equality based on the protection of human dignity." See Evadné Grant, "Dignity and Equality", (2007) 7:2 Human Rights Law Review at 299 at 299. See also, Rory O'Connell, "The Role of Dignity in Equality Law: Lessons from Canada and South Africa," (2008) 2 International Journal of Constitutional Law at 267-286; Beverley Baines, "Is Substantive Equality a Constitutional Doctrine?" at 67, online: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1028944>; and Beverley Baines & Ruth Rubio-Marin, "Introduction", in Beverley Baines & Ruth Rubio-Marin, eds., *The Gender of Constitutional Jurisprudence*, (Cambridge: Cambridge University Press, 2005) at 13-14.

groups. A substantive equality of innovation capability principle demands the recognition of indigenous ingenuity and protection of indigenous innovation and genetic resources under an inclusive innovation regulatory system based on patents, trade secrets, *sui generis* protection, open source, and government support. The main objectives of respecting and protecting indigenous innovation are to "return respect to Indigenous peoples, provide for the survival of future generations, and operate as a means to assert self-determination."[201] Indigenous entrepreneurship is "the creation, management and development of new ventures by Indigenous people,"[202] "for the purpose of diminishing Indigenous disadvantage through culturally viable and community acceptable wealth creation."[203]

Creativity and ingenuity are not culturally specific and are indeed common in both developed and developing countries. However, the current intellectual property regime tends to favour Western science and culture and is biased against indigenous innovation. The patent system is born in a unique Western culture that respects individualistic values and promotes technological novelty and industrial and commercial prowess. In particular, the underlying philosophy and ideology of the patent institutions are shaped by Western capitalistic markets and technological enthusiasm. As a result, indigenous innovation is not generally protected by law, but considered a public good in the public domain.[204] For example, indigenous medical and agricultural innovations have difficulty receiving

[201] Danielle M. Conway, "Promoting Indigenous Innovation, Enterprise, and Entrepreneurship through the Licensing of Article 31 Indigenous Assets and Resources", (2011) 64 S.M.U. L. Rev. 1095 at 1097.
[202] Kevin Hindle & Michele Lansdowne, "Brave Spirits on New Paths: Toward a Globally Relevant Paradigm of Indigenous Entrepreneurship Research", (2005) 18 J. Small Bus. & Entrepreneurship 131 at 132-133, cited in Danielle M. Conway, "Promoting Indigenous Innovation, Enterprise, and Entrepreneurship through the Licensing of Article 31 Indigenous Assets and Resources", (2011) 64 S.M.U. L. Rev. 1095 at 1096-1097.
[203] Kevin Hindle & Peter Moroz, "Indigenous Entrepreneurship as a Research Field: Developing a Definitional Framework from the Emerging Canon, (2009) 6 Int'l Entrepreneurship & Mgmt. J. at 16.
[204] See Doris Estelle Long, "Traditional Knowledge and the Fight for the Public Domain", (2006) 5 J. Marshall Rev. Intell. Prop. L. 317; Michael Halewood, "Common Law Aboriginal Knowledge Protection Rights: Recognizing the Rights of Aboriginal Peoples in Canada to Prohibit the Use and Dissemination of Elements of their Knowledge", (2005) doctoral thesis submitted to Osgoode Hall Law School, York University.

protection under the formalized intellectual property system. This is partially because indigenous people's knowledge "cannot easily be described or communicated in ways that lend it to IP protection."[205] The effect of this bias is "to underestimate the presence and vital role of applied knowledge in all societies including those appearing to be the most backward and traditional."[206]

I argue that it is necessary to make indigenous knowledge part of the equation in promoting innovation. Moreover, respecting indigenous knowledge systems and enabling local innovation capabilities are important ingredients to promoting substantive equality of innovation capability.

3.6 Freedom to Innovate as an Intrinsic and Instrumental Freedom

Innovation is fundamentally about freedom: free access to, and wide dissemination of, information is the cornerstone of an open knowledge society which nurtures and enlightens minds; intellectual freedom to question established theories and authorities is indispensible for breakthrough research which unveils possibilities we are yet to explore as a species; political freedom to debate and dissent in public deliberation and collective policymaking synergizes pluralistic strengths within the confines of a common citizenry; the freedom to act upon, incorporate, and eventually transform, knowledge in the public domain to novel solutions to technological, commercial, and social problems is vitally important not only to wealth creation and the empowerment of people, but also to more equitable distribution of development resources and human capabilities.

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[205] Graham Dutfield, "Making TRIPS Work for Developing Countries", in Gary P. Sampson & W. Bradnee Chambers, eds., *Developing Countries and the WTO: Policy Approaches*, (New York: United Nations University Press, 2008) at 141.
[206] *Ibid*., at 143.

The freedom to innovate can be used in both a negative sense (freedom from interference with innovative activities or freedom from coercion) and a positive sense (freedom to make basic decisions that enable innovation). The negative freedom to innovate protects individuals from the consequences of the activities of other individuals and requires the freedom from excessive intellectual property restrictions. The procedural freedom to innovate is concerned primarily with whether, and how, consent is obtained in the decision-making process that affects people's innovation capability. As I see it, the freedom to innovate goes beyond the negative and procedural freedom and requires positive and substantive freedom.

Innovation freedom is the freedom to act upon, incorporate, and eventually transform knowledge in the public domain to novel solutions to technological, commercial, and social problems. A person's innovation freedom is represented by having different choices of using their innovation capabilities to achieve valued objectives and is measured by the extent of the innovation capabilities that people actually have. In short, innovation freedom is the authentic self-direction in choosing innovation models and the real opportunity to extract value from one's innovation capability.

The freedom to innovate is perceived as both instrumental (as a means of self-actualization and personality enablement) and substantive (as an end in itself). Innovation capability can be measured based on the instrumental freedoms people have. For example, an immigration system that facilitates freedom of movement, particularly of scientists and high-tech professionals, is conducive to the building of human capitals and creating opportunities for collaboration. Another example is that market-oriented freedoms, such as the freedom to enter into contract and own property, are critical to the effective functioning

of entrepreneurship and technology transfer. Substantive freedom to innovate emphasizes the important role that freedom plays in human development. The freedom to innovate cannot be produced by merely the lack of the constraints imposed by intellectual property law. It requires something more substantive—an affirmative ability—to access knowledge and information in the innovation commons.

More specifically, there are five sets of freedoms that governments should guarantee in order for the substantive equality of innovation capability to be implemented in practice:

(1) the freedom to accommodate for equal innovation opportunities;

(2) the freedom to choose innovation models and allocate innovation resources;

(3) the freedom to cultivate an accessible innovation commons;

(4) the freedom to nurture entrepreneurial spirit; and

(5) the freedom to respect, protect, and fulfill indigenous innovation

3.7 Conclusion: Bridging Global Innovation Divide for Equitable Development

Development theorists have shifted their focus from studying development as an economic growth phenomenon and national gross product (GNP) to framing the right to development as a basic human right; from accumulation of wealth to fair and equitable distribution of social welfare, from gaps in physical, labour, and capital resources to gaps in knowledge resources and innovation capability. Knowledge and information form the raw material of progress and are the new form of wealth. Innovative ideas along with the

capability to transform these ideas into tangible benefits lie at the heart of development discourse in the knowledge economy.

As the focus of development thinking shifts away from regulating state relations to promoting people's welfare, development policies should strengthen redistributive systems, access to knowledge, and the cultivation of innovation capability. An Innovation Capability Approach to development provides alternative incentives to innovate for achieving development goals. The essence of the Capability Approach is to develop a nation through empowering its people and providing them with all the opportunities to develop their potential and realize their self-worth. The essence of an Innovation Capability Approach is to enhance both the efficiency (productivity improvement and economic growth) and equity (human welfare and equal access to development opportunities) of development policies by channeling aggregated ingenuity into intellectual production and cultivating innovation capability in the knowledge-based global economy.

Chapter Four: Patent as Part of an Innovation System

The patent has been seen as an important tool for the development of an innovation-based knowledge economy. Patent institutions with similar setup have been established in virtually all countries in the world. In general, a well-functioning patent system is capable of stimulating investment in innovation, improving overall industrial performance and competitiveness, promoting trade and investment, and fostering technological innovation.

Notwithstanding its importance in incentivizing and organizing knowledge production, the patent system is neither the only legal and policy measure to promote innovation, nor the most important part of a society's innovation system.[1] There are many legal and policy instruments that governments can use to direct the flow of innovation resources and strategize innovation priorities. For example, government subsidy and prizes are important for modern innovation in such fields as defense, aerospace, and agriculture. These fields of publicly-funded innovations usually require huge upfront investments and long-term commitment which the private sector lacks.[2] Another example is open innovation systems. The recent success of open and user innovation seems to suggest that people often innovate without the incentives of monopoly rights. It is important to understand why this is so and how patents function in an innovation system. In particular, we should ask: what are the impacts of the patent regime on innovation? Does the patent system provide the optimal method for motiving innovation? What else is needed to optimize an innovation system?

[1] Claude Henry & Joseph E. Stiglitz, "Intellectual Property, Dissemination of Innovation and Sustainable Development", (October 2010) 1 Global Policy 237, online: <http://onlinelibrary.wiley.com/doi/10.1111/j.1758-5899.2010.00048.x/pdf>.
[2] See William W. Fisher III, *Promises to Keep: Technology, Law, and the Future of Entertainment*, (Stanford University Press, August 2004) Chapter 6: An Alternative Compensation System.

How should the patent system be designed to optimize an innovation system that is sensitive to stimulators other than patent monopoly?

It should be emphasized that this chapter does not argue for a universal approach to abolish, weaken, or strengthen the current patent system. Rather, it provides a normative and positive analysis of patent's role in fostering innovation for development and suggests ways in which the patent system can be integrated into an innovation system that depends on both patent monopoly and non-proprietary incentives to enhance innovation capability and ensure innovation freedom. It argues that the patent regime should not be viewed as merely a private property system for protecting innovators, but as part of a broader regulatory system for protecting a healthy innovation environment. This thesis envisions patent as a means to promote innovation freedom and substantive equality of innovation capability. In this sense, patent represents not only a novel technological art, but also a vehicle to achieve freedom and equality.

The purpose of patent as part of an innovation system is two-fold: (1) to enhance innovation capability of the current and future innovators by providing sufficient incentives to engage in innovative activities and requiring the disclosure and *teaching* of new ideas to the general public; and (2) to ensure the freedom to determine the mode and direction of innovation by not obstructing the flow of information and foundational innovation resources.

Evaluating whether and to what extent a particularly designed patent system fulfills its purposes should factor in all economic, cultural, social and political costs and benefits emanating from patent monopoly. In other words, the effectiveness of patent as an innovation-promoting social arrangement should not only be measured by profits, but by the

enhancement of innovation capability in the personal realm and the promotion of entreprenurial culture, social justice, and democratic engagement in the knowledge society as a whole. A patent system can only be justified if it creates more total benefits than total costs.

An underlying theme of this chapter is patent's normative commitment to distributive justice (intergenerational justice as well as global justice). I argue that the patent system should equally distribute innovation resource and opportunity at least to the point of guranteeing everyone has access to the necessary innovation resources (building block of knowledge) to be able to earn a decent living and participate as dignified and contributing members of the knowledge society.

This chapter is structured as follows: Section One analyzes patent's normative role in an innovation system by articulating its nature and purpose. Section Two gauges the effectiveness of patent in innovation promotion using an inclusive method to measure multiple dimensions of innovation capability. Section Three implements the substantive equality of innovation capability and its underpinning five principles in a national patent law context. I argue that the patent system can promote substantive equality of innovation capability or do so more effectively by integrating itself into an innovation system that upholds equality of innovation opportunity, neutrality of innovation models, accessibility of the innovation commons, dignity of the entrepreneurial spirit, and respect for indigenous innovation. Section Four depicts the optimal design of the patent system that focuses on innovation capability and freedom. Section Five summarizes main arguments and the five underpinning principles to guide the integration of the patent system into an innovation system.

4.1 A Normative Analysis of Patent's Role in an Innovation System

Following an introduction of what patent rights entail and justifications for patent protection, this section articulates the nature of patent rights as a bargain between the patentee and the public and the scope of patent rights as a balancing instrument between innovation and access. It aims to reveal the complexity of both the motivation to innovate and the roles that patent can and should play in the societal and organizational structures which motivate innovation. Further, it addresses the purpose of the patent system and the relationship between patent protection and innovation promotion. Finally, it argues that patent rights should be constructed to justifiably serve patent law's purpose while serving social values and policy objectives. Through careful design and fine-tuning, the patent system should focus on enhancing innovation capability and freedom while not deterring other models of innovation.

4.1.1 The Overview and Justifications of the Patent System

Intellectual property law has been claimed to be the most significant mechanism for promoting innovation. Intellectual property broadly refers to the legal rights in the products of intellectual endeavor. It generally consists of two categories: copyright, if the intellectual creation is in the literary and artistic fields; and industrial property, if the intellectual creation is in the industrial field. Article 2(viii) of the 1967 *Convention Establishing the World Intellectual Property Organization* (WIPO) provides that "intellectual property shall include rights relating to:

> literary, artistic and scientific works,
>
> performances of performing artists, phonograms, and broadcasts,

inventions in all fields of human endeavor,

scientific discoveries,

industrial designs,

trademarks, service marks, and commercial names and designations,

protection against unfair competition,

and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields."[3]

Patent, in particular, is said to be imperative for creating the right conditions under which innovations can be generated and applied in a commercial context. A patent is an official grant to the inventor(s) by the government of a bundle of rights to exclude others from making, using, selling or importing an eligible invention for a limited time and for a specific territory.[4] In order for a product, process, or composition to be patentable, it must possess a minimum degree of non-obviousness, usefulness and novelty. In addition, it must describe the invention to a satisfactory degree of details to impart on the general public new knowledge.

A patent grants only a negative right to exclude others from producing, using or selling the subject matter to which the right is attached, but not an affirmative or complementary

[3] See *WIPO Convention*, *supra,* note 1 in chapter 1.

[4] Cornish and Llewelyn write: "[p]atents are granted in respect of inventions, i.e. technological improvements, great and small, which contain at least some scintilla of inventiveness over what is previously known." See William Cornish & David Llewelyn, *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights*, 6th ed., (London: Sweet & Maxwell, 2007) at 7. See also, WIPO, *WIPO Intellectual Property Handbook: Policy, Law and Use*, WIPO Publication No. 489, at 17, online: WIPO, <http://www.wipo.int/export/sites/www/about-ip/en/iprm/pdf/ch2.pdf>. It defines a patent as "a document, issued, upon application, by a government office (or a regional office acting for several countries), which describes an invention and creates a legal situation in which the patented invention can normally only be exploited (manufactured, used, sold, imported) with the authorization of the owner of the patent. 'Invention' means a solution to a specific problem in the field of technology. An invention may relate to a product or a process. The protection conferred by the patent is limited in time (generally 20 years)."

right to practice the invention described in the patent claims.[5] Patent rights have more to do with the relationship between the patentee and patent institutions than the relationship between the patentee and the invention. For example, the practical ability to exploit the patent (e.g., by making and selling) may depend on further regulatory approval, as is the case with medicinal invention, or permission from the holder of a prior-issued patent, as is the case with overlapping patents. In the latter case, when the patent in question is derived from a prior-issued patent, the inventor may be prohibited from practicing her invention if a prior-issued patent has overlapping claims and has not expired. This scenario is not uncommon, especially in biotechnology industries, where overlapping patents may make the patentee an infringer of others' patents by practicing her own invention.

The natural law justifications for property are traceable to John Locke who focuses on labour and desert; and to Hegel, who focuses on the imperative of property in the development of personality. Patents are rarely justified on the natural law theory because it is difficult to argue that an inventor has a "natural" or "moral" right to her invention. The political liberty and personal autonomy justifications, advanced by Friedrich Hayek, "treat private property as an essential pillar in the protection of political liberty."[6] The utilitarian

[5] The negative nature of patent right has been noted in patent law casebooks as a basic conceptual starting point. Judge and Gervais write: "A patent provides negative rights to exclude others from exercising the patentee's exclusive rights." Elizabeth F. Judge & Daniel J. Gervais, *Intellectual Property: The Law in Canada*, 2nd ed., (Toronto: Carswell, 2011) at 643 [Judge & Gervais, *Intellectual Property*]. The leading patent treatise in the United States states that "a patent grants to the patentee and his assigns the right to exclude others from making, using, and selling the invention. It does not grant the affirmative right to make, use or sell." See 5-16 Chisum on Patents § 16.02[1] (2006); Donald S. Chisum *et al*., *Principles of Patent Law: Cases and Materials,* (New York: Foundation Press, 1998) at 4. Merges and Duffy write: "A patent includes only the right to exclude and nothing else. Patent rights are wholly negative rights—rights to stop others from use—not positive rights to use the invention." Robert P. Merges & John F. Duffy, *Patent Law and Policy: Cases and Materials*, 3rd ed., (Newark, NJ: LexisNexis, 2002) at 48.

[6] Stewart E. Sterk, "Intellectualizing Property: The Tenuous Connections between Land and Copyright", (2005) 83 Wash. U.L.Q. 417 at 422.

justifications emphasize the enhancement of economic efficiency and social welfare generated by a property system.

Patents are primarily justified on utilitarian grounds.[7] Patents are primarily treated as a man-made institution justified on the overall social benefit and economic incentives that patent monopoly provides.[8] The two often-cited utilitarian justifications are the incentive theory and disclosure theory. The incentive theory assumes that without patent protection there would not be enough incentives for people to invest their intellectual efforts and financial resources in innovative activities. Thus, it would be difficult to keep the stream of innovations flowing. Some even doubt that innovation would exist at all without adequate and enforceable patent rights. A patent functions both as a reward to the inventor for the introduction of technological developments and as an incentive for further innovation.

The disclosure theory asserts that inventors are granted exclusive rights and competitive advantages for disclosing new and industrially applicable ideas in detailed patent specifications. This enables future innovators and the general public to learn from the new technologies and ideas. In return, the society gains from enriched public knowledge domain and more innovative activities. Therefore, patent protection enhances the overall innovation capability and social welfare by unleashing entrepreneurship and powering economic growth.

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[7] For example, Michael Carrier writes: "the patent and copyright laws grant inventors a right to exclude. This right permits them to charge prices in excess of the marginal cost of producing their inventions so that they can not only recover their initial expenditures but also receive profits. The right to exclude is designed to increase appropriability and, consequently, the level of innovation in society." See Michael A. Carrier, "Cabining Intellectual Property through a Property Paradigm," (2005) 54 Duke L.J. 1 at 33. [Carrier, "Cabining IP through a Property Paradigm"]

[8] Arrow, "Economic Welfare and the Allocation of Resources for Invention", *supra,* note 38 in chapter 1, at 614-616 (discussing information's properties of indivisibility and inappropriability).

In summary, patents are neither exactly rights nor property in their classic meanings.[9] Rather, they are perhaps best viewed as limited commercial privileges created by governments to ascribe artificial legal status of property to inventions of social utility. Patent laws function both to stimulate scientific research and investment in innovation commercialization and to foster economic growth. The primary objectives of patent law are to (1) promote innovation by providing incentives to exploit human ingenuity; (2) encourage the disclosure of new information in order to increase the public domain of commonly-owned knowledge upon which future innovation is based; and, as a result, (3) promote technological progress and economic growth.

4.1.2 The Nature of Patent as a Bargain to Balance Access and Innovation

According to the bargain theory, the inventor is granted term protection of a limited nature and scope in exchange for a detailed disclosure of the invention in order to enable members of the public the freedom to access and learn knowledge and the capability to implement their own innovative ideas in the market-place after the patent protection expires. Once the duration of 20 years from the date of filing expires, the patented invention falls in the public domain.

A patent can be deemed as a simple contract between the government and the patentee. The simple *quid pro quo* is that the patentee discloses his invention to the public in exchange for exclusive patent protection for his invention for a limited time from the

[9] Professor Brook Baker states: "Patents are not 'property' in the traditional sense—they are government granted rights that are intended to balance the interests of innovators and the public at large, and which are granted by governments with many express and implied conditions. …" See Brook K. Baker, "The Eight Deadly Lies of Big Pharma", available online: The Nation (Thailand) (April 21, 2007) <http://www.nationmultimedia.com/2007/04/21/opinion/opinion_30032324.php>.

government.[10] The Supreme Court of Canada held in *Pioneer Hi-Bred Ltd. v. Canada (Commissioner of Patents)*:

> In Canada the granting of a patent means the kind of contract between the Crown and the inventor in which the latter receives an exclusive right to exploit his invention for a certain period in exchange for complete disclosure to the public of the invention and the way in which it operates.[11]

The patent system should reflect a balance between providing incentives to innovators and access to the general public. Incentives are provided through conferring market power to patent owners, allowing them to charge over-competitive price. Access is provided through limiting patent owners' exclusive rights and giving the public the freedom to engage in scientific research and implement their innovative ideas in the market. Members of the public are both users and potential innovators who need access to knowledge and information to innovate on their own. Christina Bohannan and Herbert Hovenkamp note:

> IP policy must try to find a balance that maximizes the net gains that result from increased exclusivity, minus the loss of social value from a diminished public domain. It must also account for the very considerable administrative and litigation costs of running the IP system as well as its propensity to make serious errors.[12]

The principle of "balance" has become a cornerstone in Canadian intellectual property law and policy. The Supreme Court of Canada has endorsed a principle of balance between

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[10] For example, Shubha Ghosh writes: "Patents, for example, grant a strong right to exclude in exchange for complete disclosure of the invention to the public". See Shubha Ghosh, "Exclusivity—The Roadblock to Democracy?" (2006) 50 St. Louis U. L. J. 799, at 806.

[11] *Pioneer Hi-Bred Ltd. v. Canada (Commissioner of Patents)*, [1989] 1 S.C.R. 1623, 60 D.L.R. (4th) 223, 25 C.P.R. (3d) 257, 97 N.R. 185 (S.C.C.) at para. 25.

[12] Christina Bohannan & Herbert Hovenkamp, *Creation with Restraint: Promoting Liberty and Rivalry in Innovation*, (Oxford, UK: Oxford University Press, 2012) at xi. [Bohannan & Hovenkamp, *Creation with Restraint*]

the users' right to access to intellectual works and the rights holders' right to just reward and fair compensation.[13] In the patent context, the court held:

> Our Court has often spoken of 'the balance struck under the Patent Act' in which the public gives an inventor the right to prevent anybody else from using his or her invention for a period of 20 years in exchange for disclosure of what has been invented. A bargain theory means that the patent is a *quid pro quo* for public disclosure of the invention … The granting of a patent in Canada can be compared to a contract between the Government of Canada, the general public, and the patentee.[14]

Similarly, the court, in *Apotex Inc. v. Wellcome Foundation Ltd*., states:

> A patent, as has been said many times, is not intended as an accolade or civic award for ingenuity. It is a method by which inventive solutions to practical problems are coaxed into the public domain by the promise of a limited monopoly for a limited time. Disclosure is the *quid pro quo* for valuable proprietary rights to exclusivity which are entirely the statutory creature of the Patent Act. Monopolies are associated in the public mind with higher prices. The public should not be expected to pay an elevated price in exchange for speculation, or for the statement of 'any mere scientific principle or abstract theorem' (s. 27(3)), or for the 'discovery' of things that already exist, or are obvious. The patent monopoly should be purchased with the hard coinage of new, ingenious, useful and unobvious disclosures.[15]

The nature of the balancing is different in the patent context than in the contexts of other intellectual property rights such as copyrights and trademarks. First, patents provide stronger protection, but for shorter term. A patent represents a stronger form of proprietary right in that there are usually very limited exemptions or limitations on the exclusive rights. For example, there is no precise analogue to the fair use exception in copyright, although patent rights are subject to important exceptions. In addition, independent inventions are not

[13] For example, the Supreme Court of Canada held: "The Copyright Act is usually presented as a balance between promoting the public interest in the encouragement and dissemination of works of the arts and intellect and obtaining a just reward for the creator (or, more accurately, to prevent someone other than the creator from appropriating whatever benefits may be generated)." See *Théberge v Galerie d'Art du Petit Champlain Inc.*, [2002] 2 S.C.R. 336.

[14] *Bristol Myers Squibb Co. v. Canada (Attorney General)*, 2005 SCC 26, [2005] 1 S.C.R. 533, at para. 133.

[15] *Apotex Inc. v. Wellcome Foundation Ltd*., [2002] 4 S.C.R. 153, 2002 SCC 77, at para. 37.

recognized in patent law, whereas independent creation is protected under copyright law.[16] An inventor who independently invents a machine cannot get protection over it if it has already been patented by someone else.[17] If, as the incentive theory posits, the purpose of a strong patent monopoly is to provide strong incentives to innovators in the production of socially-desirable innovations, the limitations and exceptions to patent rights are meant to provide liberties to the public from which the next generation of innovators originate.

Second, patent rights are subject to important conditions and exceptions. The exploitation of patent right is conditioned upon disclosure of a technological invention that meets subject matter requirements and is "useful", "novel", and "non-obvious." The disclosure must be sufficient to enable someone "skilled in the art" to "work" the patented invention after its expiration.[18]

To summarize, balance between innovation incentives and public access is a guiding principle in patent law and policy-making. The patent system should strike a balance between the interests of innovators and those of the general public by properly defining the scope of private monopoly power to give innovators sufficient incentives to innovate, while providing the public with adequate access to the fruits of their intellectual efforts.

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[16] Tom G. Palmer, "Are Patents and Copyrights Morally Justified? The Philosophy of Property Rights and Ideal Objects", (1990) 13 Harv. J. L. & Pub. Pol'y 817, at 829.

[17] For example, Sir Jagadish Chandra Bose and Marconi both worked on radio communication during the same period, but only Bose is recognized as the inventor of radio.

[18] Article 27(3) of the Canadian *Patent Act* prescribes the specification requirement of a patent application. See *Patent Act*, R.S.C., 1985, c. P-4. In the US, the best mode requirement requires that a patent applicant must completely describe the best way to implement the invention in the patent specification. 35 U.S.C. § 112.

4.1.3 The Purpose of Patent as a Device to Promote Innovation Capability and Freedom

The purpose of patent law has been addressed in both national and international patent legislation, court cases and scholarly writings. TRIPS Agreement Article 7 highlights the impact of intellectual property rights on "technological innovation", "transfer and dissemination of technology", and "social and economic welfare".[19] A WIPO publication states that patent protection is "a means to encourage creative activity, industrialization, investment, and honest trade."[20] The purpose of the Chinese Patent Law is prescribed in Article 1 as:

> [P]rotecting the lawful rights and interests of patentees, encouraging inventions-creation, promoting the application of invention-creation, enhancing innovation capability, and promoting the advancement of science and technology and the economic and social development.[21]

The United States Supreme Court held that the ultimate purpose of the Patent Act was innovation promotion:

> [The] purpose [of patent power] has two dimensions. Most obviously the grant of exclusive rights to their respective writings and discoveries is intended to encourage the creativity of 'Authors and Inventors'. But the requirement that those exclusive grants be for 'limited Times' serves the ultimate purpose of promoting the 'Progress of Science and useful Arts' by guaranteeing that those innovations will enter the public domain as soon as the period of exclusivity expires.[22]

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[19] Article 7 provides: "The 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 obligations."

[20] World Intellectual Property Organization, *International Protection of Industrial Property*, (Geneva: WIPO, 1996).

[21] See Article 1 of Patent Law of P.R.China (2008), available online: <http://www.wipo.int/wipolex/en/text.jsp?file_id=178664>.

[22] See *Eldred v. Ashcroft*, 537 U.S. 186, 223 (2003).

In Canada, "[a] major purpose of the patent system is to stimulate the creation and development of new technologies … At the same time, a patent is supposed to give the public information about the technologies to which it relates that might otherwise be kept secret. Further experiment and advance by all are thus encouraged and, on the patent's expiry, the invention goes into the public domain for anyone to exploit as they wish."[23] In summary, patent law is primarily to promote innovation and secondarily to reward patent rights holders.[24]

The above discussion focuses on the proprietary and economic characters of patent and its ability to stimulate the production of innovative goods and services. This approach undermines the profound effects of patent on broader non-economic social interests and human capabilities. For example, patent laws affect our ability to think and learn by restricting access to foundational knowledge and sharing information in the innovation commons. In addition, patent laws constrain the freedom to exercise our intellectual resources (ingenuity) in generating valuables and meaningful linkages (networks and relationships) from the combination of existing knowledge with communal resources or the application of existing knowledge in a new context.

I propose an innovation capability approach to patent protection which goes beyond inducing technological innovations and accounts for promoting intellectual growth and autonomous experience of self-actualization, while preserving the space for equal opportunity to innovate and innovation freedom in the global knowledge economy. As a UN

[23] David Vaver, *Intellectual Property Law: Copyright, Patents, Trade-Marks*, (Toronto: Irwin Law, 2011) at 271 [Vaver, *Intellectual Property Law*]; see also, Judge & Gervais, *Intellectual Property*.
[24] See, e.g., Stijepko Tokic, "Intersection between the Patent System and Antitrust Laws: Patents Speeding, Antitrust Yielding, Innovation Bleeding!" (2011) 5 Akron Intell. Prop. J. 19 at 30, citing *Mazer v. Stein*, 347 U.S. 201, 219 (1954).

report puts it, "At its best, the Knowledge Society involves all members of a community in knowledge creation and utilization. [It] is not only about technological innovations, but also about human beings, their personal growth, and their individual creativity, experience and participation."[25] In this respect, Sibusiso Sibisi advocated for "inclusive growth through innovation," which means that "innovation should promote social transformation, poverty reduction and job creation … and enable a greater ability for people to be involved in the economy."[26]

I argue that patent law should reach beyond its traditional goal of merely incentivizing innovation and promoting disclosure and instead engage the mass ingenuity of citizens, safeguard their freedom to do basic research, and facilitate the wide dissemination of knowledge and inheritance of the public knowledge domain. I suggest that we should think more about patent's role in building a vibrant public knowledge domain, nurturing entrepreneurial spirit, enhancing innovation capability and securing the freedom to innovate. This approach recognizes the diversity of innovation models and promotes participation of people from different cultures and values in innovation processes.

4.2 The Effectiveness of Patent in Enhancing Innovation Capability

Innovation capability has multiple dimensions. It is driven not only by technological development, but also by business model transformation, institutional change, norm-shifting

[25] See United Nations, Understanding Knowledge Societies: In Twenty questions and answers with the Index of Knowledge Societies, ST/ESA/PAD/SER.E/66, (New York: United Nations, 2005) at 150.
[26] Catherine Saez, "Switzerland Most Innovative Economy, Global Divide Persists, Says WIPO/INSEAD Index", (July 3, 2012), available online: <http://www.ip-watch.org/2012/07/03/switzerland-most-innovative-economy-global-divide-persists-says-wipoinsead-index/?utm_source=weekly&utm_medium=email&utm_campaign=alerts>. See also, WIPO/INSEAD, *Global Innovation Index 2012 Edition*, available online: <http://www.globalinnovationindex.org/gii/index.html>. [WIPO/INSEAD, *Global Innovation Index 2012*]

in open and collaborative innovation culture, and social interaction of innovation networks. I argue that the effectiveness of patent in enhancing innovation capability should not be measured solely by economic benefits, but by cultural, social and political benefits produced by patent monopoly as well. In particular, significant non-economic benefits include the enhancement of innovation capability in the personal realm and the promotion of entreprenurial culture, social justice, and democratic engagement in the knowledge society as a whole.

4.2.1 The Measurement of Innovation Capability

The systematic measurement of innovation capability is the necessary first step to evaluate the effectiveness and performance of proprietary and non-proprietary systems in promoting innovation.[27] What makes a particular country more capable to innovate than others? If we take innovation itself as the end "product", the above question can be put differently: what makes a particular country a more efficient producer of innovation, or a more efficient market for innovation?[28]

[27] "No one knows the optimal shape of IP rights. That is, no one knows what length or breadth of patent or copyright protection would maximize innovation. …and part of the uncertainty is the difficulty of reducing innovation to measurable outputs that could be calibrated." Carrier, "Cabining IP through a Property Paradigm", s*upra,* note 7 in chapter 4, at 34.

[28] The innovation market analysis has been used in competition/antitrust context. For example, in the United States, the Department of Justice/Federal Trade Commission Antitrust Guidelines for the Licensing of Intellectual Property at §3.2.3, state: "An innovation market consists of the research and development directed to particular new or improved goods or processes, and the close substitutes for that research and development." See also, Malcolm Coates, "Efficiencies in Merger Analysis: An Institutionalist View", (2005) 13 Sup. Ct. Econ. Rev. 189 at 222-223; Lawrence B. Landman, "Did Congress Actually Create Innovation Markets", (1998) 13:2 Berkeley Tech. L.J. 721; Alvin R. Chin, "The Misapplication of Innovation Market Analysis to Biotechnology Mergers", (1997) 3 B. U. J. Sci. & Tech. L. 165; Lawrence B. Landman, "Competitiveness, Innovation Policy, and the Innovation Market Myth: A reply to Tom and Newberg on Innovation Markets as the 'Centerpiece' of 'New Thinking' on Innovation", (1999) 13 St. John's J. Legal Comment. 223; Darren S. Tucker, "Seventeen Years Later: Thoughts on Revising the Horizontal Merger Guidelines" (ABA, Oct. 2009) Antitrust Source, online: <http://www.ftc.gov/os/comments/horizontalmergerguides/545095-00024.pdf> (last visited August 30 2012); Margaret Brennan, *et al*., "An Innovation Market Approach to Analyzing Impacts of

I argue that the traditional measurements for innovation are not comprehensive enough to capture multiple dimensions of an innovation system. We should not limit the outputs of an innovation system to the tangible economic benefits emanating from innovative ideas. Rather, the outputs of an innovation system should also include the freedom to engage in the autonomous exercise of one's intellect and the capability to extract fair compensation and reward in proportion to one's contribution. The broad economic, cultural, social and political dimensions of innovation diversify the normative analysis of what ought to be counted as innovation outcomes, and help mitigate the global innovation divide between developing and developed countries.

4.2.1.1 The Intellectual, Technological, and Financial Dimensions of Innovation Input

A number of innovation indexes or scoreboards have been constructed to measure the performance or efficiency of an innovation market. Each index employs different methodologies, collates different variables, and combines various components to form a weighted sum. The following two indices show some common components that have been used in measuring innovation performance or efficiency.

The 2012 Global Innovation Index conceptual framework is built around innovation input and output to measure the capabilities of economies to innovate and their ability to make use of their innovation.[29] The innovation input is analyzed through five pillars: institutions, human capital and research, infrastructure, market sophistication, and business

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Mergers and Acquisitions in the Plant Biotechnology Industry", (2005) 8:2&3 Agbio Forum 89, online: <http://www.agbioforum.org/v8n23/v8n23a05-pray.pdf>. (last visited August 30 2012)

[29] WIPO/INSEAD, *Global Innovation Index 2012, supra,* note 26 in chapter 4.

sophistication. The innovation output is analyzed through knowledge and technology outputs and creative outputs.

Another prominent example is the Innovation Capability Index formulated by the United Nations Conference on Trade and Development (UNCTAD) in its World Investment Report 2005.[30] The UNCTAD Innovation Capability Index (UNICI) consists of two equally weighted subindexes: the Technological Activity Index and the Human Capital Index.[31] The Technological Activity Index measures innovative activity by using three innovation indicators: researchers in R&D, the number of United States Patent and Trademarks Office (USPTO) patents granted, and the number of scientific and technical journal articles. The Human Capital Index measures skills availability for such innovative activity by calculating educational enrolment (the adult literacy rate and the gross secondary and tertiary enrollment rate).[32]

It can be seen from the above two examples that innovation input has intellectual, technological, and financial dimensions. The intellectual dimension refers to human resources and can be measured by youth education attainment level, the percentage of the population with tertiary education, and participation in lifelong learning.[33] The technological dimension refers to science and technology infrastructure and can be measured by access to communication technology and broadband penetration rate.[34] The financial dimension refers

[30] United Nations Conference on Trade and Development, *World Investment Report 2005: Transnational Corporations and the Internationalization of R&D*, (New York: United Nations, 2005), available online: <http://unctad.org/en/docs/wir2005_en.pdf> (last visted 19 December 2012). [UNCTAD, *World Investment Report 2005*]
[31] *Ibid*.
[32] *Ibid*.
[33] Christine Greenhalgh & Mark Rogers, *Innovation, Intellectual Property, and Economic Growth*, (Princeton: Princeton University Press, 2010).
[34] *Ibid*.

to investment in R&D and can be indicated by public and private R&D expenditures as a percentage of GDP.[35] At any given time in a given innovation market, technological and financial inputs can be seen as approximately constant. The intellectual resource is the most transformative component and decisive of productivity and efficiency in an innovation market. Therefore, how intellectual inputs interact with and transform the technological and financial inputs to produce innovation is the key parameter for the efficiency of innovation.

However, the traditional patent system undermines the transformative force of intellectual inputs by restricting the innovation capability of users (potential innovators), and thus making innovation unsustainable and costly. This is particularly problematic for countries lacking innovation capability because technological followers and innovation users reside mostly in developing and least developed countries. Rochelle Dreyfuss noted that countries lacking innovation capability would unlikely catch up after TRIPS entered into force: "Innovation is knowledge-intensive. Educating a citizenry to the level where it is technically and culturally sophisticated enough to innovate at globally competitive levels may become prohibitively expensive once intellectual property rights are recognized."[36]

4.2.1.2 The Economic and Non-Economic Dimensions of Innovation Output

There are four main categories of output in an innovation market: economic gains, enrichment of entrepreneurial culture, social utility, and democratic gains of the inclusive

[35] *Ibid*.
[36] *Supra,* note 93 in chapter 2, at 29.

participation in an innovation market.[37] I propose that the legal system should pay more attention to the non-economic dimensions of innovation output.

Amongst the four components of output, economic gains and proprietary values expressed at market price are the predominant outputs with which the traditional intellectual property regime is concerned. The number of patents is often used as an indicator of innovation output. For instance, the main feature of patent rights for patentees is the ability to exclude competitors and to gain monopolistic economic rewards for a limited term. Indeed, there seems to be an alarming undervaluation of other non-economic aspects of innovation outputs. However, properly conceived, innovation outputs go well beyond pure economic gains and extend to enabling multi-dimensional human development, enriching cultural and social life, and strengthening participatory democratic governance. Yochai Benkler observes that a networked information economy "holds great practical promise: as a dimension of individual freedom; as a platform for better democratic participation; as a medium to foster a more critical and self-reflective culture; and ... as a mechanism to achieve improvements in human development everywhere."[38] Hence, innovation outputs should be measured by the accumulative outputs of economic gains, enrichment of entrepreneurial culture, social utility, and democratic gains in an innovation market. I will examine these four outputs in order.

With respect to economic gains, given the international dimension and dynamic nature of markets for innovation, returns on investment in research and development vary

[37] This categorization is inspired by the definition of "profit" from peer production to "connote both direct and indirect financial returns as well as social, cultural and democratic gains." See Jeremy de Beer, "Legal Strategies to Profit from Peer Production", (2008) 46 Can. Bus. L. J. 269 at 271.
[38] Yochai Benkler, *The Wealth of Networks*, *supra,* note 15 in chapter 1, at 2.

according to the quality of the invention, the management skill of those directed operations, market conditions, and availability of substitutes in the marketplace and distribution channels. More specifically, the main determinants of the returns on investment in commercializing R&D results revolve around the following factors: (1) the quality of the invention measured by its propensity to be commercialized and potential profits generated in the commercialization process; (2) the quality of the entrepreneurship measured by management skills, availability of physical as well as financial resources, and customization to local markets; and (3) the quality of the market measured by market size, competition level (or substitutability of the commercialized invention), preference, etc.

With respect to the cultural dimension of innovation outputs, an open and vibrant innovation commons or public domain is important to make innovation a deeply embedded value, sustain the innovation cycle, and achieve development goals. Innovation capability and entrepreneurship are inextricably linked to the culture and value systems of a society. For example, "[c]ultures that value and reward entrepreneurial behaviours will have a higher propensity to develop and introduce radical innovations that shift the status-quo."[39] An open knowledge society, first and foremost, is based on the free access to and wide dissemination of information. Intellectual pluralism and tolerance to diversity are important to create the flexible environment and space needed for experimentation and innovation. A vigorous civil society and well-informed citizenry are active participants of decision-making and public deliberation. Synergy and tolerance to diversity are two powerful engines to induce innovation. A vibrant innovation commons is vitally important since it facilitates the

[39] The Entrepreneurialist, "Mapping the Innovation Landscape: Richard Jefferson, Entrepreneurship and 'The Right to Do'", (April 2 2011) available online: <http://theentrepreneurialist.net/2011/04/02/mapping-the-innovation-landscape-richard-jefferson-entrepreneurship-and-the-right-to-do/>.

utilization of information and information-embedded goods and tools, by releasing their information output openly and managing them as a shared commons, rather than as restricted property.[40]

With respect to the social dimension of innovation outputs, innovation is a highly interactive process of collaboration across a growing and diverse network of stakeholders, institutions, and users. Since innovation capabilities are decentralized and widely dispersed, it is necessary to build social networks that establish serendipitous encounters and connect grassroots innovators. Social networks are also a means of diffusing knowledge through collaborative mechanisms to facilitate access to and use of knowledge. Social networks increase connectivity and interactability between innovators in the innovation market and expedite circulation of information and knowledge. Technological innovation has great impact on social innovation and should be employed in such a way that facilitates dynamic social exchange, cultivates an open and collaborative social environment, and builds formal and informal social connections – all of which are important to build systemic and widely distributed innovation capabilities. In particular, collaborative technologies can harness the power of social networks and transform the ways in which social change takes place. The most profound transformation of society might originate in the cultivation of innovation capability of each individual, regardless of his or her background, ethnicity, and belief, and building of a community of innovators collaborating vigorously towards a deeply-embedded culture of innovation.

With respect to the political dimension of innovation output, an innovation market should also strengthen transparency, accountability, and democratic participation.

[40] Benkler, *Wealth of Networks*, *supra,* note 15 in chapter 1, at 320.

Transparency requires that decisions are made in a clear, open way. Accountability requires that political actors be held accountable for what they do.[41] Democratic participation requires that people who are affected by decisions have a say in the decision-making process.[42] As Professor Jack Balkin pointed out, democracy in the broad sense is "far more than a set of procedures for resolving disputes. It is a feature of social life and a form of social organization."[43]

> A democratic culture is a culture in which individuals have a fair opportunity to participate in the forms of meaning-making that constitute them as individuals. Democratic culture is about individual liberty as well as collective selfgovernance; it concerns each individual's ability to participate in the production and distribution of culture.[44]

Democratic participation in innovative production promotes human development and enhances everyone's capability to innovate. Lack of access to information and means by which free-flowing and free-exchanging ideas inspire new ventures render people incapable of engaging in democratic participation in innovation production. Lack of access to information is not the result of information shortage, but rather of a lack of accessibility to information. I argue that patent law must facilitate the ability of all citizens to participate in making knowledge of our world and to benefit materially from their innovative production.

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[41] See OECD, *From Aid to Development: The Global Fight against Poverty*, (Paris: OECD, 2012) at 128, available online: <http://dx.doi.org/10.1787/9789264123571-en>.

[42] Lea Shaver states: "Access to knowledge is a demand for democratic participation, for global inclusion and for economic justice." Lea Shaver, "Intellectual Property, Innovation and Development: The access to knowledge approach", in Lea Shaver, ed., *Access to Knowledge in Brazil: New Research on Intellectual Property, Innovation and Development*, (Information Society Project, 2008), available online: <http://www.law.yale.edu/documents/pdf/isp/a2kbrazil_bkmk.pdf>.

[43] Jack M. Balkin, "Digital Speech and Democratic Culture: A Theory of Freedom of Expression for the Information Society", (2004) 79 N.Y.U. L. Rev. 1 at 32.

[44] *Ibid*., at 1.

4.2.1.3 The Efficiency of Innovation Market

The efficiency of innovation depends on the relationship between the outputs of innovation and the inputs of resources used to produce it. There are two ways to increase the efficiency of innovation in a certain market: decreasing the inputs of innovation/costs for conducting innovative activities (e.g., R&D) or increasing the outputs of innovation/benefits of commercializing R&D results. As to the former, the efficiency of an innovation market is increased if it uses less physical, financial, and intellectual inputs to produce a certain rate of innovation. As to the latter, the efficiency of an innovation market is increased if it can produce a higher accumulation of outputs (i.e., rate of innovation) with the fixed amount of physical, financial, and intellectual inputs.

With respect to decreasing the costs of innovation, I propose the best way is through the optimal exploitation of intellectual resources. The costs of intellectual inputs are most relevant to the productivity of skilled labour, which depends on a vibrant innovation common and a well-performing innovation system. The high costs of innovation inputs are partially caused by the lack of a vibrant innovation commons to breed innovation capability and the removal through intellectual property rights of the freedom to innovate. In particular, a strong patent regime raises the costs of intellectual inputs in the innovation market for four reasons. First, a patentee is free to set a supra-competitive price for her invention and deny access to the patented invention by those who cannot afford the commercialized invention. Second, valuable information for follow-on research and innovation is not always adequately disclosed in patent documents to enable public learning. Third, as more and more valuable information is covered by patent protection, future innovators have to either invent around

existing patents or maneuver their way through licence negotiations and royalty payments.[45] This could be very expensive, impractical, and incur high transaction costs. In some circumstances, follow-on innovation could be deterred or even blocked from getting to market by a company with a large portfolio of minor patents.[46] Fourth, the removal of the freedom to innovate induces high opportunity costs because the potential innovators may be in a better position to maximize the benefits of the invention than the patent holders and their assignees and licensees.[47]

One of the mechanisms to reduce the costs of innovation inputs and better exploit intellectual resources is through open and collaborative innovation. With the decrease in communication costs and increase in the flow of people, capital and information, the ability to connect and collaborate with a vast network of innovators and the freedom to use vital information and build upon prior knowledge are key determinants of innovation capability.

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[45] Rebecca Eisenberg and Richard Nelson identify inefficient aspects of patents that may inhibit future research: "patents on essential materials and processes may require researchers to seek licences before they proceed, which can impose significant transaction costs. … Having the relevant knowledge and materials freely available in the public domain minimizes transaction costs by relieving users of the need to identify and bargain with intellectual property owners." See Rebecca S. Eisenberg & Richard R. Nelson, "Public vs. Proprietary Science: A Fruitful Tension?" (Spring 2002) Daedalus 89 at 92.

[46] Howard C. Anawalt, *Idea Rights: A Guide to Intellectual Property*, (Durham, N.C.: Carolina Academic Press, 2011) at 210.

[47] Broad patent claims (beyond the actual invention) on fundamental discoveries limit research cooperation and slow scientific progress. Patents "may give patent holders broad control over future research paths, allowing them to block research by rivals. Patents on fundamental discoveries that open up new research areas are typically broader than patents on incremental technological advances in established fields, because the principal constraint on the scope of patent claims is the prior state of knowledge in the relevant field. Broad claims on early discoveries that are fundamental to emerging fields of knowledge are particularly worrisome in light of the great value, demonstrated time and again in the history of science and technology, of having many independent minds at work trying to advance a field. Public science has flourished by permitting scientists to challenge and build upon the work of rivals. Intellectual property rights to fundamental discoveries threaten to limit the number of players in the system at an early stage, thereby diminishing its power." See Rebecca S. Eisenberg & Richard R. Nelson, "Public vs. Proprietary Science: A Fruitful Tension?" (Spring 2002) Daedalus 89 at 92-93. See also, Rebecca S. Eisenberg, "Bargaining Over the Transfer of Proprietary Research Tools: Is This Market Failing or Emerging?" in Rochelle Cooper Dreyfuss, Diane Leenheer Zimmerman, & Harry First, eds., *Expanding the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society,* (Oxford: UK: Oxford University Press, 2001) 209-249 [Dreyfuss, Zimmerman, & First, *Expanding the Boundaries of Intellectual Property*]; Heller & Eisenberg, "Patents Deter Innovation?" *supra,* note 36 in chapter 1, 698-701.

Collaborative research is a logical advancement of the undergoing regional and global economic integration process. In fact, the integration of economies more broadly can be an institutional vehicle for mobilizing, sharing, and using existing scientific and technological capabilities, including human and financial resources as well as physical infrastructure for R&D and innovation. The cosmopolitan inspired network culture of open and collaborative innovation has fundamentally changed the way we innovate. Therefore, innovation capabilities are strengthened through the exchanges between knowledge systems and collaborations across geographical boundary.

4.2.2 The Relationship between Patent and Innovation Capability

The patent system is not necessarily at odds with innovation. In fact, it is intended to promote innovation. However, it has some problems that make it less effective than it could be in promoting innovation. This section analyzes the relationship between innovation and patent protection and identifies factors that influence whether, and to what extent, patent systems facilitate or hinder the cultivation of innovation capability.

The intellectual property regime in general and patent regime in particular play a "pervasive and complex" role in promoting innovation depending on the countries' historical, social, economic, and legal conditions and development stages.[48] As Joseph Stiglitz points out, the positive correlation between the strength of patent protection and the positive effects on innovation is difficult to establish.[49] On the one hand, patents create an

[48] Hiroyuki Odagiri, *et al*., eds., *Intellectual Property Rights, Development, and Catch-up*, (Oxford, UK: Oxford University Press, 2010) at 2.

[49] Joseph Stiglitz writes: "As difficult as it may be to assess the costs of the inefficiencies arising from patent protection, it is perhaps even more difficult to assess the extent to which (strengthened) intellectual property rights might lead to higher innovation." See Joseph Stiglitz, "Towards a Pro-Development and Balanced Intellectual Property Regime", keynote address presented at the WIPO Ministerial Conference on Intellectual

incentive for formal technology transfer and investment in R&D and may promote a pro-competitive environment.[50] Patents also facilitate financing in knowledge-intensive industries and help to increase dynamic competition by facilitating entry of new or small businesses with limited assets.[51] On the other hand, patents may inhibit innovation by impeding imitation and reverse engineering, raising transaction costs, and stifling cumulative innovation.[52]

The static view that patent protection always promotes innovation has been challenged as problematic.[53] For example, it is argued that "the link between intellectual property protection and innovation, however appealing on its face, is spurious as a general theory."[54] It is problematic to assume that innovation is a natural result of patent rights or that stronger patent protection will necessarily lead to more innovation. Part of the misunderstanding may be due to a popular romantic conception of the nature of the innovation process and characteristics of innovators themselves.[55] Patent protection is but

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Property for Least Developed Countries, Seoul, October 25, 2004, online: <http://www2.gsb.columbia.edu/faculty/jstiglitz/download/2004_TOWARDS_A_PRO_DEVELOPMENT>.

[50] See, e.g., Philippe Aghion & P. Howitt, "A Model of Growth through Creative Destruction", (1992) 60 Econometrica, 323-351; Paul M. Romer, "Endogenous Technological Change", (1990) 98:5 Journal of Political Economy, 71-102; Gene Grossman & E. Helpman, "Quality Ladders and Product Cycles", (1991) 106:2 Quarterly Journal of Economics 557-86.

[51] See Bronwyn H. Hall, "Patents and Patent Policy", (2007) 23:4 Oxford Review of Economic Policy 568; Bronwyn H. Hall, "Business Method Patents, Innovation, and Policy", Department of Economic, University of California at Berkeley, Working Paper No. E03-331, 2003, available online <http://euro.ecom.cmu.edu/program/law/08-732/Patents/BusinessMethodPatents.pdf>.

[52] Michele Boldrin & D.K. Levine, "The Case Against Intellectual Property", (2002) 92 American Economic Review Papers and Proceedings, 209-212; and Michele Boldrin & D. K. Levine, "IER Lawrence Klein Lecture: The Case Against Intellectual Monopoly", (2004) 45 International Economic Review 327-350.

[53] William Fisher, "Intellectual Property and Innovation: Theoretical, Empirical, and Historical Perspectives", in Industrial Property, Innovation, and the Knowledge-based Economy, (2001) 37 Beleidsstudies Technologie Economie, online: <http://cyber.law.harvard.edu/people/tfisher/Innovation.pdf>.

[54] See Kojo Yelpaala, "Quo Vadis WTO? – The Threat of TRIPS and the Biodiversity Convention to Human Health and Food Security", (2012) 30 B.U. Int'l L.J. 55 at 89.

[55] "There is general acceptance of a Romantic vision of innovation and the presumption that any alternative claim to use or access a work by prior contributors or second generation creators be subject to the discretion of the legally designated inventor." See Bryan Bachner, *Intellectual Property Rights and China: The Modernization of Traditional Knowledge*, (Utrecht: The Netherlands, Eleven International Publishing, 2009) at

one of the incentives to innovate; but this incentive is often overemphasized.[56] Human innovation is a complex enterprise and cannot be attributed to strong patent protection alone without taking into account other similarly – if not more – important factors, such as taxation, investment regulations, production incentives, trade policies, and competition rules.[57] In addition, an innovator is often fantasized as a heroic figure who single-handedly makes breakthrough inventions and builds an entrepreneurial empire.[58] This solitary genius type of innovator is not representative of the innovation pattern today, which is intimately linked to teamwork and, above all, enormous investments and network resources.[59] In fact, most economically significant inventions are the result of incremental technological change facilitated by collaboration and social interactions, rather than the intelligence of one single innovator.

Patent protection is "not necessary or desirable to encourage innovation."[60] First, a large number of innovations have taken place without the benefits of intellectual property protection.[61] In certain industries patenting is the least significant factor in spurring

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88. See also, Paul Kuruk, "Protecting Folklore under Modern Intellectual Property Regimes: A Reappraisal of the Tensions between Individual and Communal Rights in Africa and the United States", (1999) 48 American U. L. Rev. 769, note 37-44 and accompanying text.

[56] See, *e.g.*, "As a powerful engine for economic growth, intellectual property rights are intimately connected with the innovation process providing for an incentive to develop technology ad infinitum." Joseph Richard Falcon, "Managing Intellectual Property Rights: The Cost of Innovation", (2004) 6 Duq. Bus. L. J. 241, at 250.

[57] See Keith E. Maskus, "The Role of Intellectual Property Rights in Encouraging Foreign Direct Investment and Technology Transfer", (1998) 9 Duke Journal of Comparative and International Law 109 at 129.

[58] "Intellectual property rights have captured a Romantic conceptualization of the creative process of innovation and invention that emphasizes individualism but overlooks the collaborative nature of the process." See Bryan Bachner, *Intellectual Property Rights and China: The Modernization of Traditional Knowledge*, (Utrecht: The Netherlands, Eleven International Publishing, 2009) at 86.

[59] For example, Bryan Backner argues that the presumption that individualism is necessary for innovation is over-stated. *Ibid*.

[60] Philip J. Weiser, "The Internet, Innovation, and Intellectual Property Policy", (2003) 103 Columl L. Rev. 534 at 570.

[61] Michele Boldrin & David K. Levine, *Against Intellectual Monopoly* (New York: Cambridge University Press, 2008); see also Brian Marlin, "Against Intellectual Property," (1995) 21 Philosophy and Social Action, at 7-22.

innovation, representing only fourteen percent of all inventions.[62] Case studies show that "in most industries patents were not an important part of the incentives firms have for investing in R&D".[63] It should be noted, however, that in biotechnology and pharmaceutical industries patents indeed play a significant role in providing incentives to invest.[64] Second, the relationship between the level of patent protection and innovation is more nuanced and less predictable than anticipated. A study by Uyen Quach shows that an increase to TRIPS level of patent protection may not automatically lead to increased innovation in developing countries.[65] Robert Hahn reviewed the extensive economic literature on the effectiveness of the patent system and concluded that: "the empirical literature is inconclusive on the question of whether stronger patents increase or decrease innovation."[66]

A study by the Organization for Economic Co-operation and Development (OECD) shows that patents encourage innovation up to a point, beyond which they become counter-productive.[67] There seems to be an "optimal" protection level to generate "maximal" innovation. Excess protection beyond this point leads to a decline in innovation. However, it is difficult to devise an overall "optimal" patent system which fits equally well in diverse

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[62] Jay B. Barney, "Competence Explanations of Economic Profits in Strategic Management", in Jerry Ellig, ed., *Dynamic Competition and Public Policy: Technology, Innovation, and Antitrust Issues*, (Cambridge, UK: Cambridge University Press, 2001) 45 at 57.

[63] Roberto Mazzoleni & Richard R. Nelson, "The Benefits and Costs of Strong Patent Protection: A Contribution to the Current Debate", (1998) 27 Res. Pol'y 273 at 274.

[64] See, e.g., Richard C. Levin *et al*., "Appropriating the Returns from Industrial Research and Development", in Martin Neil Baily & Clifford Winston, eds., 3 Brookings Papers on Economic Activity, (Washington, D.C.: Brookings Institution, 1987) 783 at 796; Roberto Mazzoleni & Richard R. Nelson, "The Benefits and Costs of Strong Patent Protection: A Contribution to the Current Debate", (1998) 27 Res. Pol'y 273 at 276.

[65] Uyen Quach *et al*., "Biotechnology Patenting Takes off in Developing Countries", (2006) 8:1/2 Int. J. Biotech. 45.

[66] "With a few notable exceptions (pharmaceuticals, for one), economists have been unable to show a clear causal link between increased patent rights and increased innovation." See Robert W. Hahn, "An Overview of the Economics of Intellectual Property Protection", in Robert W. Hahn, ed., *Intellectual Property Rights in Frontier Industries: Software and Biotech*, (Washington, D.C.: AEI-Brookings Joint Center for Regulatory Studies, 2005), at 11. See also, Robert W. Hahn, "The Economics of Patent Protection: Policy Implications from the Literature", available online: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=467489>.

[67] OECD, Science and Innovation, *Patents and Innovation: Trends and Policy Challenges*, (Paris: OECD, 2004), online: OECD <http://www.oecd.org/dataoecd/48/12/24508541.pdf>.

technological fields and economic conditions.[68] This implies a flexible application of patent law under different conditions. Further, patented inventions may not be readily or quickly developed into commercially-valuable products and services.[69] In fact, a large number of patented inventions may never be developed and commercialized.[70]

Furthermore, evidence on the long-term economic impacts of patents on innovation performance remains inconsistent, inconclusive, or sometimes completely absent. [71] Although some empirical studies have shown the important role of the patent system in stimulating technological development and promoting invention commercialization, the data also show that patents are not the most important means of (1) increasing the rate of innovation; or (2) appropriating returns to innovation.[72] As to the rate of innovation, Edwin Mansfield empirically studied the impact of a possible abolition of the patent system on the rate of innovation in US firms and found that the effects of abolition would be small in most industries, with the exceptions of pharmaceuticals and chemicals, for which the patent

[68] Ove Granstrand, "Innovation and Intellectual Property Rights", in Fagerberg, *Oxford Handbook of Innovation, supra,* note 164 in chapter 3, 266 at 280. [Granstrand, "Innovation and Intellectual Property Rights"]

[69] In the 1960s, the Department of Commerce found that the average time from invention to market introduction was over nineteen years. Battelle Memorial Institute, Science, Technology and Innovation (NSF C667) (1973) at 96.

[70] Uyen Quach *et al*., "Biotechnology Patenting Takes off in Developing Countries", (2006) 8:1/2 Int. J. Biotech. 45.

[71] "Empirical evidence on the role of IP protection in promoting innovation and growth in general remains limited and inconclusive. Conflicting views also persist on the impact of IPRs in the development prospects." See Ruth L. Okediji, "Development in the Information Age: Issues in the Regulation of Intellectual Property Rights, Computer Software and Electronic Commerce", (May 2004) UNCTAD-ICTSD Project on IPRs and Sustainable Development, online: <http://www.iprsonline.org/unctadictsd/docs/CS_Okediji.pdf>, at vi. See also, A. Samuel Oddi, "The International Patent System and Third World Development: Reality or Myth?" (1987) Duke L. J. 831, at 842.

[72] F.M. Scherer, "The Propensity to Patent", (1983) 1:1 International Journal of Industrial Organization 107-128; A. Arundel & I. Kabla, "What Percentage of Innovations are Patented?: Empirical Estimates for European Firms", (1998) 27:2 Research Policy 127-141; Edwin Mansfield, "Intellectual Property Protection, Direct Investment and Technology Transfer: Germany, Japan and the USA", (2000) Special issue 19:1/2 International Journal of Technology Management; Petra Moser, "How Do Patent Laws Influence Innovation?: Evidence from Nineteenth-Century World's Fairs", (2005) 95:4 American Economic Review 1214.

system was shown to be essential.[73] By collecting data on imitation costs and times, Edwin Mansfield's empirical case study shows that, apart from the pharmaceutical industry, patents have not been essential for the rate of innovation.[74] In addition, increased patenting may not increase the ability to appropriate investment returns from innovation.[75] A Yale survey of industrial R&D managers in the US in more than a hundred industries investigated sector-specific variations in appropriability conditions and found patents to be less effective than other means of maintaining competitive advantage.[76] Their study concluded that innovations would continue to appear without the prospects of patent protection and that patents were insufficient to appropriate benefits from innovation. A significant exception to this general finding was pharmaceuticals, where patent protection was deemed to be especially valuable. Following the Yale survey, a Carnegie-Mellon survey revealed that only about 10% of respondents rated patents as the first or second most important means of securing returns to innovation.[77] It also showed "substantial nation- and sector-specific differences in the use of

[73] Professor Edwin Mansfield found that absent patent protection, 65 percent of innovations in the pharmaceutical industry and 30 percent in the chemical industry would not have been brought to the market, whereas less than 18 percent of innovations in other industries depend on patents. See Edwin Mansfield, "Patents and Innovation: An Empirical Study", (1986) 32:2 Management Science 173-181. See also, Claude Barfield & John E. Calfee, *Biotechnology and the Patent System: Balancing Innovation and Property Rights*, (Washington, D.C.: American Enterprise Institute Press, 2007) at 27. However, some have questioned Mansfield's study as misleading because it omitted the fact that the share of total expenditures allotted to R&D spending as a percentage of sales was twelve to nineteen percent in the pharmaceutical sector compared to an overall U.S. industrial average of 3.5 percent. See e.g., The Boston Consulting Group, Sustaining Innovation in U.S. Pharmaceuticals: Intellectual Property Protection and the Role of Patents 22 (Jan. 1996).

[74] "Excluding drug innovations, the lack of patent protection would have affected less than one-fourth of the patented innovations in our sample." Edwin Mansfield, Mark Schwartz & Samuel Wagner, "Imitation Costs and Patents: An Empirical Study", (1981) 91 Econ. J. 907 at 915.

[75] Uyen Quach notes: "If the biotechnology patents of developing countries will not lead to other competitive advantages for their biotechnology sectors such as attracting venture capital funding or to be a negotiating tool in establishing joint ventures and alliances, etc., then their increased patenting may not give developing countries good returns on their investments." Uyen Quach, *et al*., "Biotechnology Patenting Takes off in Developing Countries", (2006) 8:1/2 Int. J. Biotech. 45.

[76] Richard C. Levin *et al*., "Appropriating the Returns from Industrial Research and Development", (1987) 3 Brookings Papers on Economic Activity 783-820.

[77] W. M. Cohen *et al*., "R&D Information Flows and Patenting in Japan and the United States", in Ove Granstrand, ed., *Economics, Law and Intellectual Property*, (Dordrecht: Kluwer Academic, 2003) at 123-154.

patents, secrecy, lead times and other means for appropriation of the returns from innovation." [78] Scherer and Weisburst studied the economic effects of strengthening pharmaceutical patent protection in Italy over a period of twenty years after the relevant patent regime was implemented and found that there was no increase in either local innovation or R&D expenditure growth through domestic investment or FDI as a result of implementing patent protection.[79] Not only was local innovation not stimulated, but many Italian companies were acquired by multinationals. This empirical evidence supports the proposition that increasing patent protection does not necessarily increase R&D expenditures or FDI in technology intensive industries, such as pharmaceutical production.[80]

Historically, major technological breakthroughs such as electricity, telephone, and Internet were not driven by patent protection. The successful experience of India's pharmaceutical industry proved that innovation was attainable and indeed very much alive during the time when the Indian patent law did not provide product patents (1970-2005).[81] In addition, virtually all industrialized countries, from eighteenth-century Britain, through

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See also, Bronwyn H. Hall, "Economics of Patents and Innovation", online: <http://ec.europa.eu/dgs/policy_advisers/docs/Benefits_Costs_Patenting_B_Hall.pdf>.

[78] Granstrand, "Innovation and Intellectual Property Rights", *supra,* note 68 in chapter 4, at 281. For instance, the Carnegie-Mellon study indicated that lead time and patents were the most important appropriation mechanisms for Japanese firms, while lead time and secrecy were most important for US firms. Several explanations have been set forth for these inter-industry differences, including industry and market structure (competitive conditions, size and diversification of firms, barriers to entry, market growth, R&D intensity etc.), and the nature of the technology (technological opportunities, codifiability, capital intensity etc.)

[79] F.M.Scherer & Sandy Weisburst, "Economic Effects of Strengthening Pharmacuetical Patent Protection in Italy", (1995) 26 International Review of Industrial Property and Copyright Law 1009 at 1023-1024.

[80] *Ibid*. The authors conclude that "the legitimization of drug product patents in Italy did not induce a market shift in Italian pharmaceutical manufacturers' strategic emphasis from emulating drugs developed elsewhere to developing innovative drugs"; research and development "expenditure growth ... did not accelerate after the patent regime transition" and "the number and character of new product launches did not change significantly."

[81] Kalpana Chaturvedi, Joanna Chataway & David Wield, "Policy, Markets and Knowledge: Strategic Synergies in Indian Pharmaceutical Firms", (2007) 19:5 Technology Analysis & Strategic Management 565. For in depth studies on the effects of increasing intellectual property protection on pharmaceuticals in India, see Shubham Chaudhuri, P. Goldberg & P. Jia, "The Effects of Extending Intellectual Property Rights Protection to Developing Countries: A Case Study of the Indian Pharmaceutical Market", (2003) NBER Working Paper 10159; and Carsten Fink, "How Stronger Patent Protection in India might Affect the Behavior of Transnational Pharmaceutical Industries", (2000) World Bank Policy Research Working Paper No. 2352.

nineteenth-century United States and Germany, to late twentieth-century Japan and Korea, used fairly loose patent protection in the earlier phase of their industrial development.[82] Historical evidence shows that strong intellectual property protections have followed, rather than caused, economic and technological development.[83] For instance, technological innovations enjoyed relatively weak patent protection in England during the decisive period of the industrial revolution, and hence were widely pirated.[84] It was not until the mid-nineteenth century after the major industrialization had occurred that English courts revised legal doctrine and adopted rigorous patent protection.[85] In other words, only after a certain level of innovation capability had been reached, did countries start to protect patent rights more rigorously.[86] In this respect, Graham Dutfield maintains: "Historically, and even today, the way patents have been justified in different countries has depended on the level of industrial development."[87]

There are mainly three ways by which a country increases its technological innovation capability. First, it can imitate and absorb existing technologies in the public domain. Second, it can create its own new technologies or adapt existing technologies to its local context. Third, it can acquire technologies from abroad through foreign investment or

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[82] Ha-Joon Chang, *Kicking Away the Ladder: Development Strategy in Historical Perspective*, (London: Anthem Press, 2002).
[83] Ha-Joon Chang, "Intellectual Property Rights and Economic Development: Historical Lessons and Emerging Issues", (2001) 2:2 Journal of Human Development 287, at 293.
[84] Harold Irvin Dutton, *The Patent System and Inventive Activity During the Industrial Revolution 1750-1852*, (Manchester University Press, 1984) at 69-81, cited in Mark J. Osiel, book review, "Lawyers as Monopolists, Aristocrats, and Entrepreneurs", (1990) 103 Harv. L. Rev. 2073 fn 127.
[85] *Ibid*.
[86] Aaron Cosbey, "The Sustainable Development Effects of the WTO TRIPs Agreement: A Focus on Developing Countries", (Winnepeg, Canada: International Institute for Sustainable Development, 1997), online: <http://www.tradeobservatory.org/library.cfm?filename=Sustainable_Development_Effects_of_the_WTO_TRI.htm>. (last visited August 30, 2012)
[87] Graham Dutfield, *Intellectual Property Rights and the Life Science Industries: A Twentieth Century History*, (Hampshire, UK; Burlington, VT: Ashgate, 2003) at 2.

patent licences. The patent system may facilitate some aspects of technology acquisition, while hindering others according to local conditions.[88]

Patent protection has dynamic and complex impacts on innovation performance through: (1) encouraging or discouraging investments in R&D and other innovative activities; (2) leading or distorting technological progress; and (3) affecting market efficiency through its impact on competition and trade.[89] There are two main factors that influence whether, and to what extent, patent systems facilitate or hinder the cultivation of innovation capability. First, the scope and strength of patent rights have the most direct impacts on innovation capability. Economists have proposed to parametrize the "optimal" length and scope of patent protection. William Nordhaus offers a general economic model of a patent system which he uses to derive the optimal length of patent protection.[90] Nordhaus argues that "increasing the length of patent protection increases the incentives for investment in process innovation (and hence "dynamic efficiency"), but at the expense of "static efficiency" (since increased protection means less competition, higher prices, and slower diffusion)."[91] An "optimal patent length", Nordhaus points out, is arrived at through a trade-off between these two effects, and through the maximization of a social welfare function.[92] An optimal patent length will depend on "the nature of competition, the price elasticity of demand and the R&D elasticity of process cost reduction."[93] In addition to optimal patent

[88] See Sean A. Pager, "Patents on a Shoestring: Making Patent Protection Work for Developing Countries", (2007) 23 Ga. St. U. L. Rev. 755 at 761-763.
[89] Granstrand, "Innovation and Intellectual Property Rights", *supra,* note 68 in chapter 4, at 278.
[90] William D. Nordhaus, *Invention, Growth, and Welfare: A Theoretical Treatment of Technological Change*, (Cambridge, MA: MIT Press, 1969).
[91] Granstrand, "Innovation and Intellectual Property Rights", *supra,* note 68 in chapter 4, at 279.
[92] Lawrence M. DeBrock, "Market Structure, Innovation and Optimal Patent Life", (1985) 28 Journal of Law and Economics 223-244.
[93] Granstrand, "Innovation and Intellectual Property Rights", *supra,* note 68 in chapter 4, at 279.

length, more recent research focuses on the optimal breadth or scope of a patent,[94] as well as optimal combinations of length and breadth.[95] Merges and Nelson show that the scope of a patent affects both private and social rates of return from patented innovations, and these returns vary according to industries and technologies.[96]

Second, the nature and pattern of progress and typical terms of innovation cycle in different technological fields also play a role in how beneficial patent protection is to innovation promotion. Burk and Lemley note that different technologies and industries have different characteristics and industrial structures, and, therefore, "there is no reason to assume that a unitary patent system will optimally encourage innovation in the wide range of diverse industries that it is expected to cover."[97] For example, Scherer observes that the patent system operates very differently for firms in the ICT sector than for those in the biotechnology and pharmaceuticals sectors.[98] Admittedly, the importance of patents in the pharmaceutical industry is higher than other sectors.[99] In this respect, innovation may be stimulated in certain industries, but stifled in others, by the same minimum level of patent protection required by the TRIPS patent regime.

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[94] "The scope of a patent defines the range of its industrial applications by delineating the set of technological designs that the claims in the issued patent give protection to (i.e., exclusion of imitators)." See, Granstrand, "Innovation and Intellectual Property Rights", *supra,* note 68 in chapter 4, at 279. For an overview of the optimal breadth and scope of a patent, see A. Jaffe, "The U.S. Patent System in Transition: Policy Innovation and the Innovation Process", (2000) 29 Research Policy 531-557.

[95] P. Klemperer, "How Broad should the Scope of Patent Protection Be?" (1990) 21:1 RAND Journal of Economics 113-130.

[96] R.P. Merges & R. R. Nelson, "On the Complex Economics of Patent Scope", (1990) 90 Columbia L. Rev. 839.

[97] Dan L. Burk & Mark A. Lemley, "Policy Levers in Patent Law", (2003) 89 Va. L. Rev. 1575 at 1577.

[98] F.M. Scherer, "Pharmaceutical Innovation" in Bronwyn H. Hall & Nathan Rosenberg, eds., *Handbook of the Economics of Innovation*, vol. 1 (Elsevier, 2010).

[99] Wesley M. Cohen, Richard R. Nelson, & John P. Walsh, *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)*, (Cambridge, MA: National Bureau of Economic Research, 2000), Working Paper No. 7552.

To summarize, patents play important roles in innovation systems – encouraging innovation, disseminating new knowledge, and incentivizing innovation commercialization – and "the importance of these roles varies across sectors (industries) and countries, and over time."[100] A well-balanced patent system is helpful, but not sufficient to optimize innovation performance of an individual, an enterprise, or a nation. The patent system is but one piece of a broader innovation system and not a panacea that automatically causes entrepreneurship to thrive. In fact, experience in developed countries demonstrates that a broad scope and strong protection of intellectual property rights and stringent enforcement rules may obstruct innovation "by making input to future innovation too costly and too cumbersome to sustain over time."[101] Therefore, a patent system should be configured to the specific policy priorities and development objectives of the country in which it functions. Moreover, it is essential to construct a broader infrastructural support and institutional guarantee for knowledge production and innovation promotion.

The negative effects of providing strong patent protection can be widely felt in daily life. The overly excessive restriction on access to technology and public knowledge domain may deter future innovation.[102] Patent protection discourages collaboration – e.g., research results may be concealed until a patent application is filed, or a biological material may be kept secret rather than submitted to a public depository. Due to the high cost involved in the

[100] "In summary, IPRs, particularly patents, play several important roles in innovation systems – to encourage innovation and investment in innovation, and to encourage dissemination (diffusion) of information about the principles and sources of innovation throughout the economy." See Granstrand, "Innovation and Intellectual Property Rights", *supra,* note 68 in chapter 4, at 280.
[101] Jerome H. Reichman, "Intellectual Property in the Twenty-First Century: Will the Developing Countries Lead or Follow?" (2009) 46 Hous. L. Rev. 1115 at 1121.
[102] Jerome Reichman, "Charting the Collapse of the Patent-Copyright Dichotomy: Premises for a Restructured International Intellectual Property System", (1993) 13 Cardozo Arts & Ent. L. J. 475.

acquisition and litigation of patents,[103] innovative activities tend to become even more centralized in large corporations and cause burden for individual innovators and small and medium-sized innovation enterprises.[104] The expenses to protect and enforce patent will, in turn, be imposed on consumers. For developing countries, the institutional requirements to set up legal and regulatory framework for patent protection can divert scarce financial and human resources from other developmental priorities. Imposing property rights on innovations involving, e.g., living organisms and materials obtained from the human body, may conflict with some people's moral and ethical standards.

4.3 Integrating the Patent System into an Innovation System

This section implements the substantive equality of innovation capability principle proposed in section 3.5 and its five underpinning elements in a national patent law context. I argue that the patent system can promote substantive equality of innovation capability or do so more effectively by integrating itself into an innovation system that upholds equality of innovation opportunity, neutrality of innovation models, accessibility of the innovation commons, dignity of the entrepreneurial spirit, and respect for indigenous innovation. By becoming part of the principle-based innovation system, the patent system can overcome its deficits and inadequacy in optimizing innovative activities, as demonstrated by some common illnesses that patent systems in the world suffer from, such as patent race and the resulting backlog, thickets of overlapping inventions, and the anti-competitive activities of patent trolls.

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[103] One of the social costs of the patent system is the allocation of legal resources to patent disputes and litigation. See Howard C. Anawalt, *Idea Rights*, *supra,* note 48 in chapter 4, at 211.

[104] WIPO, *Recommendations for Strengthening the Role of Small and Medium-Sized Innovation Enterprises in Countries of the Commonwealth of Independent States, prepared by the Division for Certain Countries in Europe and Asia*, available online: <http://www.wipo.int/export/sites/www/dcea/en/pdf/tool_6.pdf>.

Why do we need to integrate the patent system into an innovation system? The patent system, as it now stands, is inefficient in utilizing innovation resources and socially unjust in distributing innovation opportunities. The optimal utilization of innovation resources would prescribe unfettered access to patented knowledge by as many users as possible once it is created.[105] However, patent protection represents under-utilization of innovation resources by collecting monopoly rents and excluding users who cannot afford high prices. In addition, economic concerns have taken predominance over societal values and public policy concerns, resulting in a discount of the non-economic dimensions of innovation output and unjust distribution of innovation opportunities. The integration of the patent system into an innovation system overcomes the limitations of a purely market-based analysis of costs and benefits of the patent system and complements the existing patent theories with a dynamic account of innovation-promotion and knowledge-production process. In a principle-based innovation system, patents should function as but one carefully balanced and optimally productive instrument to generate, order, and distribute commercial, technological, and social justice interests at large.

This section does not advocate for the abandonment of the patent system or present extenuating circumstances for weakening patent protection. It aims to re-calibrate the patent system to induce socially-valuable innovation and suppress anti-competition measures. Moreover, it envisions an "innovation capability-enhancing and freedom-promoting" patent system that balances the short-term social cost of patent monopoly and long-term gain of increased innovation, and corrects the undue dilatations in the scope of patent rights.

[105] Bohumir Pazderka & Klaus Stegemann, "Pharmaceutical Innovation as a Collective Action Problem: An Application of the Economic Theory of Alliances", (2005) 8:2 Journal of World Intellectual Property, 157 at 161-162.

4.3.1 Distributing Innovation Opportunities Fairly

This sub-section discusses distributive justice questions raised by the patent regime and suggests ways to enhance the overall fairness of the patent system in distributing innovation opportunities. Patent-induced technological advancement and innovation-driven growth have created immense innovation capabilities in some parts of the world, but have not equalized the opportunities for all to grow in innovation capabilities and benefit from innovative activities. Michael Perelman argues that patent rights are inherently unfair because they benefit a small minority of rights holders to the detriment of the overall population.[106]

This type of criticism raises important distributive justice questions: how should we provide incentives for the generation of innovation while ensuring the fair distribution of its benefits? What should be distributed? Should the subject to be distributed be innovation costs and benefits, innovation resources, innovation opportunities, or innovation capabilities? To whom the subjects are distributed? What are the substantive and procedural rules by which the distribution is based on? These questions are important because the ways innovation is produced and distributed determines, in large part, who will benefit from it. Moreover, what type of innovation is incentivized by patent law influences the flow of innovation resources and monopoly power. Patents provide incentives for research and investment in protectable innovations. This is sometimes inappropriate or inadequate because it may undercut its ability to protect indigenous innovation, which is usually unprotectable due to its ancient roots and informal and communal characters.

[106] Michael Perelman, *Steal this Idea: Intellectual Property Rights and the Corporate Confiscation of Creativity,* (New York: Palgrave, 2002).

It is necessary to clarify some core concepts at the outset. An innovation opportunity is the individual's chance of acting upon, and extracting value from, a new idea emanating from the exercise of her intellect and ingenuity if she seeks it. Innovation resources refer to material and informational resources devoted to the promotion of innovation. Innovation capabilities are the person's abilities to employ and allocate innovation resources in order to achieve valuable outcomes. Innovation capabilities reflect her freedom to allocate innovation resources in one way or another, and her real opportunities or positive freedom to choose between different ways of employing innovation resources available to her. An innovation commons involves material and knowledge resources placed in the commons for the promotion of innovation. An innovation commons is thus an institution in which private agents engage in collaborative intelligence to solve the innovation problem by developing rules for the creation and sharing of innovation resources and for the governance of those resources.

What does the equality of innovation opportunity entail? First, the government should ensure that everyone has basic access to the fundamental innovation resources. Second, the government should safeguard their freedom to act upon their innovative ideas, either as an individual pursuit, or in collaboration with others. Third, the government should ensure everyone has equal opportunity to participate freely as full members of the knowledge society. Thus, equality of innovation opportunity places an obligation on the state to prevent some individuals from gaining an unfair advantage over others through patent monopoly in the competition for innovation resources.

How can the patent system contribute to the fair distribution of innovation opportunity? I suggest that the patent system should distribute innovation opportunity at

least to the point of guaranteeing everyone has access to the necessary innovation resources (building block of knowledge) to be able to earn a decent living and participate as dignified and contributing members in the process of knowledge creation. Within a sovereign state, this requires that all members of society should be eligible to compete for innovation resources on equal terms. Further, a government should provide its citizens with equal opportunity to learn and to pursue an intellectual life that fulfills their personal inspirations.

More specifically, there are three mechanisms that can be employed to operationalize the equality of innovation opportunity in the making of patent law, designing of patent administration, and setting up patent institutions. First, when making patent laws, governments should include intergenerational justice and distributive justice as part of the normative goals of patent law. Intergenerational equality requires that future generations have the same equal innovation opportunities as their predecessors. In Locke's term, current innovators should leave "enough and as good" innovation resources in the innovation commons for the generations to come. The principle of intergenerational equity is generally considered a part of customary international law.[107] For example, the preamble of the Convention on Biological Diversity (CBD) acknowledges intergenerational equity, by noting the Contracting Parties' determination to "conserve and sustainably use biological diversity for the benefit of present and future generations."[108] Distributive justice requires that everyone should have an equal opportunity to obtain innovation resources and cultivate innovation capabilities. Shubha Ghosh states: "With concepts of prior art and public domain,

[107] See G.F. Maggio, "Inter/Intra-Generational Equity: Current Applications under International Law for Promoting the Sustainable Development of Natural Resources", (1997) 4 Buffalo Environmental Law Journal 163.

[108] Preamble. *Convention on Biological Diversity*, 1760 UNTS 79; 31 ILM 818 (1992), online: <http://www.cbd.int/convention/text/>. [CBD]

intellectual property serves as a bridge between past and present with the artifacts of the present as tools for the future."[109] He uses the term "synchronic" to refer to "different generations co-existing at one point in time when intellectual property policy is made."[110] "Diachronic", on the other hand, extends beyond the current generation to include "different generations across different periods of time," including both past and future generations.[111] Thus, synchronic fairness in distributing innovation opportunities is important to achieve distributive justice and diachronic fairness in distributing innovation opportunities is important to achieve intergenerational justice.

In addition to the normative foundation, governments should devise the scope and strength of patent rights as well as limitations and exceptions to patent rights to achieve a differentiated scheme of patent protection. Mark Lemley argues that "the proper goal of intellectual property law is to give as little protection as possible consistent with encouraging innovation."[112] Competitive markets will continue to work as long as the innovators can make enough money to cover their investments in producing the innovation – "there is no need to fully internalize benefits in intellectual property."[113]

With respect to the scope of patent rights, "patent scope must be metered by legal policy in ways that grant the patentee enough to incentivize innovation, but not enough to stifle future development."[114] Patent law should leave certain subject matter outside the scope of patent protection (particularly life forms, plant varieties, business methods, and

[109] Shubha Ghosh, "Forward: Why Intergenerational Equity", (2011) 2011 Wis. L. Rev. 103 at 103.
[110] *Ibid*., at 107.
[111] *Ibid*., at 107.
[112] See Mark A. Lemley, "Property, Intellectual Property, and Free Riding", (2005) 83 Tex. L. Rev. 1031 at 1031 (discussing differences between tangible and intangible property).
[113] *Ibid*., at 1032.
[114] Bohannan & Hovenkamp, *Creation with Restraint, supra,* note 14 in chapter 4, at 71.

software) and set tiered standards of patentability criteria (in particular, non-obviousness and inventive steps) according to the sensitivity a particular subject matter is to patent incentives. The freedom of differentiation means the freedom to treat different subject matter differently. How sensitive a particular patentable subject matter is to patent protection depends on a range of factors, including the nature of technological progress in certain fields, the innovation cycle, the quality of patent administration, governance structure, rule of law, etc. It should be emphasized that the differentiation of protection level according to the sensitivity of a subject matter to patent incentives should not be considered a violation of TRIPS Article 27 which prohibits discrimination as to "the field of technology".[115] This is because the criterion used to differentiate is their sensitivity to patent incentives rather than "the field of technology". In addition, patent law should provide an appropriate scope for exceptions (e.g., research and experimental use, regulatory review, compulsory licences and governmental use exceptions) and limitations so as to avoid the encroachment upon the innovation commons.

Second, when designing patent administration, governments should recognize that innovators have unequal intellectual endowments and financial resources and thus appropriate accommodation should be provided to enable the disadvantaged to compete on equal terms with those more powerful competitors in an innovation market. For example, accommodation should be available to ensure equality of innovation opportunity between a high school student who spends a few hours every week and a few hundred dollars to develop iPhone applications and a software engineer at a leading multinational company

[115] Article 27.1 states: "… patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced." See TRIPS Article 27.1.

with physical, financial and human resources and institutional support for patent prosecution and litigation. The accommodation can be provided through making the substantive and procedural rules for patent acquisition, commercialization, and enforcement more accessible, as well as making the patent information more systematized and accessible.

As to the former, an example would be aligning patent application fee structures with innovation resources of different innovators and lowering fees for small entities and individual inventors. Further, countries should provide legal aid to disadvantaged innovators to defend their legitimate rights against abusive competitors or bad faith litigants. In addition, their right to a fair trial, right to due process, and right to legal representation should be safeguarded by the legal system.

As to the latter, an example would be making sophisticated patent metrics publicly available. More specifically, the government should, through compiling and making available freely to the public patent statistics, reduce confusion as to which right holders (patentees, licensees, asignees) own what rights, strengthen patents' role of teaching new technological art and facilitating information exchange, and clarify the boundaries of the innovation commons for its more effective deployment. The "Patent Lens", or what Richard Jefferson calls "innovation cartography", is a good example for mapping out a complex web of patent licences and cross-licences and crystallizing the boundaries of innovation commons.[116]

[116] "Patent Lens is a worldwide, open-access, free full-text patent informatics resource. It serves as the cyberinfrastructure platform for the Initiative for Open Innovation (IOI)." Available online: <http://www.patentlens.net/> (last visited August 31 2012).

Third, when setting up patent institutions, the patent office has an important role to play in operationalizing the fair distribution of innovation opportunity. I suggest that the patent office should become a regulatory agency to administer innovation production.[117] More specifically, the patent offices should examine patent specifications more stringently to ensure the standards of sufficient description are met. Careful examination of patent specifications can filter out non-deserving patents and steer innovation resources towards more innovative endeavors. In particular, the patent office should refuse patent applications on research tools as these tools cover important methods for manipulating information and if properly designed and shared, can change the direction and pace of innovation. For example, in life sciences they are methods or techniques for manipulating or understanding living systems, including genes. The patent office can involve a diverse group of people in contributing their time and expertise in preventing oversights and omissions in patent examination and improving the quality of patents granted. The United States and Australia have introduced pilot programmes to involve the public, particularly in patent examination and opposition procedures, and have achieved quite positive outcomes. The United States Patent Office deployed wiki-like software to allow the scientific and legal public to collaborate on finding prior art relevant to the examination of pending patent applications.[118]

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[117] Nodal governance: Manuel Castells, Materials for an Exploratory Theory of the Network Society, (2000) 51 Brit. J. Soc. 5 at 13-14 (noting that nation-states have begun to build partnerships to retain influence within the increasingly predominant "network society"); R.A.W. Rhodes, *Understanding Governance: Policy Networks, Governance, Reflexivity, and Accountability*, (Buckingham, UK: Open University Press, 1997) at 51-59 (describing how British governance evolved through development of interconnected networks of public-private partnerships); Clifford Shearing & Jennifer Wood, "Nodal Governance, Democracy, and the New 'Denizens", (2003) 30 J.L. & Soc'y 400 at 401-403 (discussing the shift in security governance from a purely state-run system to a cooperative system between states and non-state agencies). For an analysis of networks in the context of international law, see Kal Raustiala, "The Architecture of International Cooperation: Transgovernmental Networks and the Future of International Law (2000) 43 Va. J. Int'l L. 1 at 70-90.

[118] Peer to Patent: Community Patent Review, online: <http://www.peertopatent.org>. See also The Peer to Patent Project: Community Patent Review, online: <http://dotank.nyls.edu/communitypatent>. Beth Simone Noveck, "Peer to Patent: Collective Intelligence, Open Review, and Patent Reform", (2007) 20 Harv. J. L. & Tech. 123.

For example, the Japanese patent office assists Small- and Medium-sized Enterprises by providing licensing advisors and a Patent Licensing Database which contains "licensing information (including transfer)" and "needs information (introduction intention information)" so that a match can be made between the parties.[119]

To summarize, with these three mechanisms in the making of patent law, designing of patent administration, and setting up patent institutions, the patent system can contribute to the fair distribution of innovation opportunity.

4.3.2 Steering Innovation Resources Neutrally

The first thing that comes to mind when people are thinking about innovation is the type of innovation that is recognized and promoted by the patent system. Patent law regulates what innovations should be recognized and how to reward them. Lack of innovative activities in much of the world is not the result of lack of innovation, but rather a lack of recognition of alternative modes of innovation and non-proprietary production-inspired human ingenuity. A truly neutral approach to steering innovation resources should not dictate specific innovation models. It should, instead, afford all members of this innovation ecosystem an equal opportunity to innovate, to create value, and to capture their fair share of the value they create.

A patent office should be entrusted with the role of a neutral innovation governor in addition to patent law administrator. Peter Drahos points out that patent offices around the world have developed a client-orientation to serve the largest users of the patent system –

[119] Japanese Patent Office Annual Report 2001, available online: <www.jpo.go.jp>.

corporations' interests.[120] This results in the issue of a large number of undeserving patents and decreasing patent quality. In addition, the administrative overload and backlog of patent applications create high pressure on patent offices. WIPO estimates that there is a backlog of over 5 million unprocessed patent applications worldwide.[121]

Drahos calls for a serious consideration of the patent social contract:

> The patent social contract is not a contract aimed at the grant of more and more patents, but rather at the diffusion of more and more significant inventions …. citizens acting rationally would only want to grant monopoly rewards to inventions that were genuinely creative …. It is high-quality inventions that society wants, not high-quality patents which can only be a means to an end and never an end in themselves.[122]

There are generally two types of legal and policy instruments other than the patent system that governments can use to direct the flow of innovation resources and strategize innovation priorities. I use "public innovation support mechanism" to refer to the government-backed innovation models and "open innovation" to refer to the commons-based and open source innovation models.

The government-backed innovation models include any direct or indirect government measures that aim to enhance national innovation capability. The most commonly used government-backed innovation model – government subsidy – is widely used in many countries. Government subsidies include tax credits, refunds, and other mechanisms that fund basic research through universities and special research agencies in fields such as defense, aerospace, and agriculture. For example, in the US much innovation in the fields of

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[120] Peter Drahos, *The Global Governance of Knowledge: Patent Offices and their Clients,* (Cambridge: Cambridge University Press, 2010).
[121] Rachel Marusak Hermann, "WIPO: IP Policy Moves to Forefront of Global Innovation", Intellectual Property Watch, (November 15, 2011). See also WIPO, *World Intellectual Property Report 2011 – The Changing Face of Innovation*, available online: <http://www.wipo.int/econ_stat/en/economics/wipr/>.
[122] *Supra,* note 122 in chapter 4, at 78-79.

aerospace, agriculture, and medicine comes from government labs operated by the National Aeronautics and Space Administration, the Department of Agriculture, and the National Institute of Health.[123] Further, government can deploy public funding and personnel to directly develop technologies. For example, due to its better understanding of local culture and customer demands, the government can identify critical areas of demands such as medicines that cure a rare disease afflicting the local population. Moreover, government can use its purchasing power to demonstrate commercial viability and reduce risks of market entry.[124] For example, the Canadian Innovation Commercialization Program (CICP), through awarding government contracts, helps Canadian businesses enter the marketplace and test their pre-commercial products or services with reduced risks.[125] Government can also use voluntary programmes and certifications to encourage innovation or compulsory licensing and competition law to deter innovation-stifling behaviours.[126]

In addition to government-backed innovation models, non-proprietary innovation models also include commons-based and open source innovation models. Two prominent examples of open source innovation are open source software and open source biology. I will use the example of open source software movement to show that a patent office should remain neutral towards innovation models. I will use the example of open source biological innovation to argue that NGOs can partner with patent offices to steer scientific discovery and innovation resources moving in the right direction. Additionally, I propose that the

[123] See William W. Fisher III, *Promises to Keep: Technology, Law, and the Future of Entertainment*, (Stanford University Press, August 2004) Chapter 6: An Alternative Compensation System.
[124] Joshua Sarnoff, "Governmental Innovation Mechanism Choices (with reference to Climate Change)", abstract available online: <http://www.stanford.edu/dept/law/ipsc/PDF/Sarnoff,%20Joshua%20-%20Abstract.pdf>. (last visted August 31, 2012)
[125] Overview of CICP, available online: Public Works and Government Services Canada, <https://buyandsell.gc.ca/initiatives-and-programs/canadian-innovation-commercialization-program-cicp/overview-of-cicp>.
[126] *Supra,* note 126 in chapter 4.

norms of open access and user's freedom to innovate ought to be established to reflect the exigencies of the dynamics of innovation paradigm. In particular, a general defence of enhancing innovation capability and freedom should be established to facilitate alternative modes of innovation. It shall be a defense to a patent infringement claim that the patent holder, in excercising (or not) her patent rights, curtails the innovation freedom of other innovators and reduces the innovation efficiency of the innovation market(s) in which the patented product or process contribute substantially to patent holder's profit.

The process of open source software production shows that the more open source software is consumed, the better it gets and more people can use it.[127] Steven Weber notes: "The essence of open source is not the software. It is the process by which software is created … Production processes, or ways of making things are of far more importance than the artifacts produced because they spread more broadly."[128] Open-source software can be freely used, copied, modified, and redistributed lawfully by anybody. A study conducted by Rishab Aiyer Ghosh shows that open-source software contributes 12 billion Euro dollars per annum to the EU's economy.[129] The popularity of open-source softwares is due partially to the special characteristics of innovation in the software sector. First, innovation is cumulative and the capital cost is low compared with pharmaceutical and biotechnology sectors. Second, technological progress is fast and the product cycle is short. Third, the competitiveness of software products depend on how well customers' needs are understood and specifically tailored to. The rapid growth of open-source software suggests that the

[127] Steven Weber, *The Success of Open Source*, (Cambridge, M.A.: Harvard University Press, 2004) at 154-155.
[128] *Ibid*., at 56.
[129] Rishab Aiyer Ghosh, "Study on the Economic Impact of Open Source Software on Innovation and the Competitiveness of the Information and Communication Technologies (ICT) Sector in the EU—Final Report", (November 20, 2006), at 10.

public ownership of intellectual property rights might be more efficient than traditional private privileges based innovation models.[130]

Turning now to open source biology, Richard Jefferson, the founder and CEO of Cambia, explains that we have developed the norms and innovation models of open innovation through several thousand years of selecting and breeding new plant varieties and domesticating animals. [131] The patent-incentivized biological inventions are heavily controlled by contracts and licences. Cambia's Initiative for Open Innovation (IOI) seeks to replicate the success of open source software in biology by "creating the freedom to innovate based on what has come before, and the freedom to deliver the fruits of such innovation with few constraints."[132]

There are potential tensions and conflicts between the patent system and non-proprietary innovation systems. However, a properly balanced patent system is able to complement alternative innovation mechanisms and contribute to the overall dynamic efficiency of the innovation system in generating innovation benefits and social utility. What matters is the ultimate impact of the patent system on innovation as a whole throughout the patent term and beyond. Within the patent term, patent protection benefits alternative innovation models through patent disclosure. When the patent expires, all of its knowledge will be in the public domain, which in turn provides resources for future innovation regardless of which innovation mode an innovator chooses.

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[130] Eric Raymond, *The Cathedral & the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*, (Cambridge, MA: O'Reilly, 1999) at 137-190.
[131] Richard Jefferson, "Ideas: Q&A", online: <http://www.cambia.org/daisy/cambia/4790/version/default/part/AttachmentData/data/Q&A.v5.pdf >.
[132] Cambia, *The Cambia BIOS Initiative: Biological Innovation for Open Society*, (2006) at 5.

To summarize, governments should steer innovation resources neutrally toward different innovation models and focus on the broader infrastructural support and institutional guarantee for knowledge production and innovation promotion.

4.3.3 Conserving Innovation Resources for an Accessible Innovation Commons

The patent system can contribute to the conservation of innovation resources and cultivation of an accessible innovation commons by balancing monopoly and freedom and by accommodating collaborative and cumulative innovation models.

An innovation commons involves material and knowledge resources placed in the commons for the sharing and production of innovation. An innovation commons, much like commons in the cultural resource environment and unlike commons in the natural resource environment, allows "participants not only to share existing resources but also engage in producing those resources."[133] Examples of innovation commons include the Internet, patent pools, open source software, collaborative innovation networks, and scientific repositories. There are two distinct features about an innovation commons. First, an innovation commons is a public place where private agents engage in collective actions to produce and share innovation resources and pool the shared innovation resources together for future innovation.[134] Second, an innovation commons is a rule-based institution for the governance of innovation resources as well as the prevention and resolution of disputes arising from pooling innovation resources.

[133] Michael J. Madison, Brett M. Frischmann & Katherine J. Strandburg, "Constructing Commons in the Cultural Environment", (2010) 95 Cornell L. Rev. 657 at 681.
[134] Jason Potts, "Innovation in the Commons," available online: <http://www.aomevents.com/media/files/ISS%202012/Potts.pdf>.

The patent system should reflect a balance between monopoly and freedom – that is, a balance between the need to promote innovation by means of granting monopoly rights on the one hand, and the freedom to access fundamental innovation resources in an innovation commons and the freedom to build upon others' ideas so as to sustain a vibrant innovation commons on the other. Put differently, the patent system reflects an "innovation versus access" paradigm: it balances providing innovators incentives and rewards for innovation and users adequate access to an innovation commons. According to the "innovation versus access" paradigm, the legitimacy and efficiency of the patent system depend precisely on the rational construction of a functional system of incentives which strike the balance between the rights of patent holders and patent users while achieving socially desirable objectives. More specifically, this requires a balance between private incentives and collective welfare, and between monopoly control and individual autonomy in innovative endeavor.

Furthermore, the patent system should be integrated into collaborative and cumulative innovation processes. Innovation is a cumulative process in the sense that access to past knowledge including disclosed patent information is essential to sustain future innovation. Given the complexity and magnitude of the innovation process, it is increasingly unlikely for one individual to possess all the knowledge, skills, and resources required to innovate. Therefore, innovation has become more reliant on strategic collaboration and multi-disciplined team efforts than individual genius. While developed countries at the technological frontier focus primarily on revolutionary innovations, it might be more fruitful for developing countries to promote cumulative innovations by utility models or petty

patents.[135] A minor innovation may provide a tailored solution to a local problem or improvements on existing technologies that patent holders have little incentive to make. As Assafa Endeshaw describes:

> There are different approaches towards minor inventions and their terms of protection as well as that for patents. Thus Indonesia accords protection to small product improvements through a "Simple Patent" (obviously a "petty patent") for one time of five years. Vietnam, on the other hand, grants protection for "Utility Solutions" for six years. By contrast, Malaysia recognizes "Utility Innovations" for a period of five years but renewable for a further five. The Philippines recognizes design patents (which include utility models) and protects them for five years, too, but with a possibility of renewals for two consecutive periods of five years.[136]

As such, an accessible innovation commons is especially important to promote innovation in developing countries since the more common innovation model there – the sequential and incremental innovation – relies on the recombination and re-use of existing knowledge. According to David and Foray, "innovation capability had to be seen less in terms of the ability to discover new technological principles and more in terms of the ability to exploit systematically the effects produced by new combinations and use of components in the existing stock of knowledge."[137] This implies more routine use of a technological base allowing for innovation and requires systematic access to the state-of-the-art technologies.

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[135] See, e.g., Alan S. Gutterman & Robert Brown, *Intellectual Property Laws of East Asia*, (Hong Kong: Sweet & Maxwell Asia, 1997) (discussing utility models and designs in various Asian countries such as China, South Korea, and the Philippines). See also, *supra,* note 103 in chapter 5, at 1124 (distinguishing between "cumulative and sequential innovation" and "path-breaking innovation" and noting that "how to protect cumulative and sequential innovation—as distinct from path-breaking innovation—becomes an ever more pressing problem as more small- and medium-sized firms acquire a taste and capacity for such innovation"); Suzanne Scotchmer, *Innovation and Incentives*, (Cambridge, MA: MIT Press, 2004) at 127–59 (discussing sequential innovation and the need to protect cumulative innovators).

[136] Assafa Endeshaw, *Intellectual Property in Asian Emerging Economies: Law and Policy in the Post-TRIPS Era*, (Burlington, VT: Ashgate, 2010) at 73.

[137] P. David & D. Foray, "An Introduction to Economy of the Knowledge Society", (2002) 54 International Social Science Journal at 9-23.

Therefore, it is essential to confront the problem of the impediments to accessing the existing stock of information that are created by intellectual property laws.[138]

Moreover, the patent system should also accommodate open and collaborative innovation models. With the emergence of new innovation models and the globalization of innovation processes, innovation capabilities have become increasingly decentralized and have begun to accumulate in traditionally less obvious locations. In light of the challenges brought by the commons-based collaborative and incremental innovation, the patent system – a proprietary regime of exclusive rights – is inadequate, by itself, to promote innovation for optimal social benefits. In particular, the liberty interests of current and potential innovators require considerations of cooperation in innovation and the value of distributed mass ingenuity. Therefore, we need a fundamentally different framework for understanding patents through the lenses of equitable distribution of innovation welfare in a coherent and comprehensive manner. The increasingly overlapping and sometimes conflicting areas of patent system and public policy require that patent law shall be made in the public interest, rather than to the benefit of a limited few in the community. The patent system should function as a legal construct and public policy tool to enhance the innovation capability of present and future innovators and ensure their freedom to operate in the innovation market without technological, regulatory or legal constraints. Within the knowledge production dynamics, patent functions as but one carefully-balanced and optimally-productive instrument to generate, order and distribute commercial, technological, and social justice interests at large.

[138] Luc Soete, Bart Verspagen, & Bas ter Weel, "Systems of Innovation", in Bronwyn H. Hall & Nathan Rosenberg, eds., *Handbook of the Economics of Innovation,* (Amsterdam: North Holland, 2010) at 1174.

4.3.4 Honoring the Dignity of Entrepreneurial Spirit and Fostering Entrepreneurship

What should be the roles of national governments in fostering entrepreneurship? Should they leave the allocation of innovation resources and distribution of innovation benefits to the market or should they intervene in the innovation market and order the direction and rate of innovation flow? Proponents of the former view argue that patent owners should enjoy unhurdled private property rights and complete freedom of contract. Therefore, governmental interference in the process of the exploitation of patent rights or negotiation of contractual arrangements is unwarranted and detrimental to free competition between private enterprises and, by extension, economic development. However, this extremist version of pure *laissez faire* fails to recognize the limitations of the market mechanism in organizing public good production and distributing the benefits of such good equitably among nations and generations. Therefore, I argue that neither pure markets nor pure command economies, by themselves, can maximize innovation opportunities and build a flourishing innovation market. They need to work together with entrepreneurship to enhance social utility and the quality of human life.

The fostering of self-actualization and striving for excellence are characteristics that form the basis for the dignity and worth of human beings. Innovation is not a luxury, but a basic need of human survival – a way to express the meaning of "self". Entrepreneurial spirit is part of the human spirit and an unquenchable expression of who we are. The spirit of entrepreneurship is as strong among the poor of the developing world as it is in Silicon Valley. The characteristics which encapsulate the entrepreneurial spirit are risk-taking, daring to be different, vision to identify potentially lucrative niche in the ideas, guide and

exploit consumer demands, persistence, being able to rise from failures, lifetime learning, intellectual curiosity, and profit-driven.

The traditional image of entrepreneurship is based on myth rather than reality. Entrepreneurship has been prescribed as a romantic panacea for world problems while entrepreneurs have been viewed as heroic figures who single-handedly build an empire in a new technology era with a flash of genius. Entrepreneurs have been described as rare genii and heroic explorers "who venture into uncharted territory and open up the new routes along which we will all be travelling soon enough."[139] However, as Professor Albert Shapiro notes,"[e]ntrepreneurs are not "born" … rather they 'become' through the experiences of their lives."[140] In fact, entrepreneurship can be learned and fostered through educational programmes and policy instruments supported by the government. Government support for innovation should be provided throughout the entire innovation commercialization cycle.

First, government initiatives are important to create the right conditions for the efficient working of the market economy (compensation, contract enforcement, entry and exit conditions, and financial intermediation). For example, government should interfere to prevent patentees from abusing their dominant positions in contractual bargaining as well as market competition. Second, active industrial policy is necessary for the promotion of economic development. Government intervention played a key role in creating successful hubs of entrepreneurial activity such as Silicon Valley. Given the importance of patents to economic development and public welfare, government regulation in an innovation market is

[139] Johan Norberg, "Humanity's Greatest Achievement", Wall Street Journal, October 2, 2006, A11.
[140] "Nurturing the Entrepreneurial Spirit", available online: <http://www.entre-ed.org/Standards_Toolkit/nurturing.htm>.

critical to the flow of technical knowledge and freedom of competition. But under certain circumstances, governments should withdraw and give more space for private initiatives.

Taking an idea to a product is risky and expensive. First, it takes vision to pick the right idea and test the feasibility of the concept. By engaging more people and relying on the intelligence of the mass, open entrepreneurship helps reduce the possibility of serious oversight and combines dispersed information. Second, it takes trust and faith to find the most suitable partner(s) and investors from a pool of candidates. Social networks increase connectivity and interactability between supplier and demander of capitals and expedite circulation of financial information. Third, in the process of making prototypes; improving prototypes; and engineering prototype-to-product, it takes care and responsibility to test safety and reliability and build manufacturing facilities. Fourth, in the final step of building a distribution and sales channel, the advantages of open entrepreneurship are more obvious.

Innovation-oriented government regulations may play a more important role in technological advancement and innovation performance than patent law.[141] Innovation policy touches diverse policy areas as complementary and yet as different as education and training, skills development, science and technology, business environment, ICT and other infrastructure.[142] In addition to the obvious factor of technological advancement, a country's social capability, including scientific and educational infrastructure, entrepreneurship, and

[141] For example, based on patent statistics, Deming Liu contends that advancement in science and technology in China is a result of the active governmental policy such as investment in R&D and not patent protection. See Deming Liu, "The Transplant Effect of the Chinese Patent Law", (2006) 5:3 Chinese Journal of International Law 733, at 745-746.

[142] Jeffrey L. Furman, Michael E. Porter, & Scott Stern, "The Determinants of National Innovative Capacity", (2002) 31 Research Policy 899-933.

legal and economic institutions, is also important in fostering innovation and economic growth.[143]

To honor the dignity of entrepreneurial spirit, governments should make it easier for an entrepreneur to turn an innovation into marketable products or services by supporting the collaboration of local researchers and foreign inventors, developing financial support instruments (stimulate markets for private risk capital, such as venture capital, angel investors, and matching grants), and improving the business environment (such as protecting intellectual property rights and enforcing contracts).

Patent law can help foster entrepreneurship. Patents function as a commercial and regulatory tool in an innovation market. Patent law is an exception to the underlying assumption of Western liberal economies that the law should favour free flow of information and freedom to engage in commerce. The patent system can be considered as regulatory intervention in market behavior and in competition. The nature and scope of patent rights is a mediating instrument through which patent law balances competing social values and policy objectives.

4.3.5 Reconciling Patent with Indigenous Innovation

The tension between the patent system and indigenous innovation has been widely recognized.[144] For example, Madhavi Sunder argues that Western intellectual property law

[143] *Supra,* note 50 in chapter 4, at 1.
[144] See generally, Lauren E. Godshall, "Making Space for Indigenous Intellectual Property Rights under Current International Environmental Law", (2003) 15 Georgetown International Environmental Law Review 513. (explaining how traditional knowledge and Western practices used to protect property remain largely incompatible) Solomon E. Salako, "Agrobiotechnology, Indigenous Peoples' Rights and Traditional Knowedge", (2012) 20 Afr. J. Int'l & Comp. L. 318; Kuei-Jung Ni, "Traditional Knowledge and Global Lawmaking", (2012) 10 Nw. U. J. Int'l Hum. Rts. 85; Trevor J. Clarke, "Finding a Remedy and Respect in

has not paid much attention to "the innovation and productive knowledge capacities of the poor ... partly because of the difficulties of fitting poor people's knowledge into Western frameworks…."[145] As a result, Sunder goes on to argue that the rich and the poor have unequal capacity to cultivate knowledge as intellectual property and gain economic remuneration from intellectual production and commercialization.[146]

Similarly, David Downes argues that "existing systems, which are oriented around the concept of private ownership and individual invention, are inherently at odds with indigenous cultures, which emphasize collective creation and ownership of knowledge."[147] The UNDP recognizes: "There is concern that IPR systems encourage the appropriation of [traditional knowledge] for commercial use without the fair sharing of benefits, or that they violate indigenous cultural precepts by encouraging the commodification of such knowledge."[148] The UNDP's Human Development Report 1999 describes current patent laws' ignorance of indigenous knowledge:

> New patent laws pay scant attention to the knowledge of indigenous people, leaving it vulnerable to claim by others. These laws ignore cultural diversity in creating and sharing innovations—and diversity in views on what can and should

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Equity: Traditional Knowledge, Inventorship, and Perspective Biosystems v. Pharmacia Biotech", (2011) 21 DePaul J. Art Tech. & Intell. Prop. L 131; Stephen R. Munzer & Kal Raustiala, "The Uneasy Case for Intellectual Property Rights in Traditional Knowledge", (2010) 27 Cardozo Arts & Ent. L.J. 37; Jay Erstling, "Using Patent to Protect Traditional Knowledge", (2009) 15 Tex. Wesleyan L. Rev. 295; Daniel Gervais, "Traditional Knowledge and Intellectual Property: A TRIPS-Compatible Approach", (2005) 2005 Mich. St. L. Rev. 137; William Fisher, "Two Thoughts about Traditional Knowledge", (2007) 70 Law & Contemp. Probs. 131; Madhavi Sunder, "Invention of Traditional Knowledge", (2007) 70 Law & Contemp. Probs. 97.

[145] Madhavi Sunder, "Intellectual Property and Development as Freedom", *supra* note 25 in chapter 1, at 461.

[146] *Ibid*.

[147] David R. Downes, "How Intellectual Property Could be a Tool to Protect Traditional Knowledge", (2000) 25 Colum. J. Envtl. L. 253 at 257.

[148] United Nations Environment Programme, Convention on Biological Diversity, Conference of the Parties, "The Impact of Intellectual Property Rights Systems on the Conservation and Sustainable Use of Biological Diversity and on the Equitable Sharing of Benefits from its Use: A Preliminary Study: Note by Executive Secretary", UN Doc. No. UNEP/CBD/COP/3/22, (1996) at para. 32.

> be owned, from plant varieties to human life. The result is a silent theft of centuries of knowledge from developing to developed countries.[149]

The conventional patent system may be used to protect indigenous innovation in some circumstances, but often either provides insufficient protection or acts as a tool to appropriate traditional knowledge. Indigenous innovation is often related to biodiversity, agriculture, health and genetic resources. It is developed, sustained and passed on from generation to generation and often forms part of its spiritual identity.[150] For example, knowledge about genetic resources, traditional agricultural practices (such as seed saving), and medicinal remedies are fundamental to maintain traditional lifestyle and a respectful relationship between human and nature. As such, indigenous innovation is not easily protected by the current patent system, which requires the identification of an individual inventor and which grants protection to inventions that meet the standards of new, non-obviousness, and utility.

The tension between indigenous innovation and the patent system is caused by how "property" and "invention" are defined under the indigenous and Western framework. Bratspies argues that protecting indigenous innovation involves "more than bringing a new form of knowledge within the scope of intellectual property law", but redefining what property should be and what should be protected under patent.[151] First, the patent system is based on Western conceptions of knowledge and property, and as a result excludes

[149] United Nations Development Program, *Human Development Report 1999*, at 68.
[150] WIPO, *Intellectual Property and Genetic Resources, Traditional Knowledge and Traditional Cultural Expressions: An Overview*, (Geneva: WIPO, 2012).
[151] Rebecca M. Bratspies, "The New Discovery Doctrine: Some Thoughts on Property Rights and Traditional Knowledge", (2007) 31 Am. Indian L. Rev. 315 at 333.

indigenous innovations that evolve naturally and communually.[152] Western approach to property rights is based on individualistic control and ownership – the fundamental function of property is to exclude all others and solely control the disposal of the property and benefits arising therefrom. In comparison, indigenous approach to property rights is based on communal guardian and "agent in trust". Indigenous innovation is rooted in communal development of knowledge rather than in individual innovation.

Second, the patent system is based on the notion of "exploitation", whereas "preservation" is the central concern of the indigenous system. Under the capitalist market economy, the pursuit of efficiency dictates that genetic resources should be exploited to the maximum extent and that technological innovation should serve the needs of current human generations. In comparison, the indigenous system values preservation. For example, genetic resources do not belong to any member of the community, but are held by the community in trust for future generations. The genetic resources can only be exploited to the extent that fulfills the needs of the current generation, but not cause harm to future generations. This implies that enough of no less quality should be preserved and left for future generations.

Third, the patent system is based on individual rights and autonomy, whereas responsibility and relationship are emphasized in the indigenous system.[153] According to the Lockean property theory, a person should have full autonomy to decide her labour and body as part of her own property, as well as the freedom to choose how to dispose the property owned, with little regard to others or the environment. In traditional communities, a person is

[152] Shawkat Alam, "Economic Globalization: Rethinking its Promises for Economic and Social Development from a Developing Country Perspective", in Shawkat Alam, Natalie Klein, & Juliette Overland, eds., *Globalisation and the Quest for Social and Environmental Justice*, (London: Routledge, 2011) 77 at 92.
[153] There is also a general "presumption that Western nations prefer private ownership and source nations or indigenous peoples prefer group or common ownership." See Sarah Harding, "Value, Obligation and Cultural Heritage", (1999) 31 Ariz. St. L.J. 291, at 304.

an inherent part of a community and has responsibility towards other members of the community and other species in the nature. A person's relationship with others and with the nature is tied to her identity.

In summary, indigenous approach to genetic resources centers on "collective, inter-generational production and community-based economies", while the conventional patent system is premised on a "capitalist market economy with undergirding concepts of exclusive ownership, alienability, and monopoly rights."[154] The case of indigenous innovation shows that those forms of ingenuity that conform to the traditional patent regime are welcomed, whereas those forms of ingenuity that challenge and threaten to overturn the traditional patent regime are unwelcomed, or even sanctioned.

4.4 The Design of the Patent System: Focusing on Innovation Capability and Freedom

The patent bargain between the patentee and the public is realized through the design of patent scope and strength, which lies at the center of the legitimacy of patent monopoly and how effective it is in promoting innovation. If the scope of protection is too narrow, prospective inventors may either resort to alternative means of protection (trade secret, for example) or divert resources to other research directions or jurisdictions. Further, inadequate patent protection discourages investment in R&D and thwarts the commercialization of patented inventions. Particularly in new technology fields, research has indicated a positive correlation between patent scope and innovative activities. For example, since the US Supreme Court in a 5-4 decision extended patentable subject matter to include a genetically-

[154] *Supra,* note 151, in chapter 4, at 331.

modified microorganism in *Diamond v. Chakrabarty*,[155] the US biotechnology industry has gained comparative advantages in the world market.[156] However, overly broad scope of patent protection increases the cost of follow-on research, stifles innovation, endangers consumer welfare, and impedes economic growth.

Although it is evidentially insufficient to propose the optimal strength and length for patent protection,[157] the patent system, as a general principle, should be designed to: (1) correspond with the specificities of technological fields and economic development levels; (2) balance between access and innovation; and (3) account for the cumulative, collaborative, and user innovation models. Together, these three principles aim to preserve the innovation commons and promote a healthy innovation environment.

First, a patent system should be designed to advance the specific technological priorities and development objectives of the country in which it functions, which requires differential application of patent standards in different technological fields and economies. The universal application of the same patent standards across different technological fields would have different impacts on innovative activities. This is because the nature and pattern of progress in different technological fields and the typical terms of innovation cycle in different industries are different. For example, the innovation cycle in pharmaceutical

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[155] *Diamond v. Chakrabarty*, 447 U.S. 303, 100 S. Ct. 2204 (1980) [*Chakrabarty*]. In contrast, the Canadian Supreme Court, in a 5-4 decision, refused to recognize higher life forms as a patentable subject matter in *Harvard College v. Canada (Commissioner of Patents)* 2002 SCC 76.

[156] Stacey Berg, *et al*., "PTO Biotechnology Patent Protection Hearing", (1994) 6:11 J. Proprietary Rts. 33 ("The patent system has played a crucial role in fueling a growing biotech industry since the Supreme Court's decision in Diamond v. Chakrabarty…").

[157] The leading classic economic study on the patent system concluded that: "no economist, on the basis of present knowledge, could possibly state with certainty that the patent system, as it now operates, confers a net benefit or a net loss upon society. The best he can do is state assumptions and make guesses about the extent to which reality corresponds to these assumptions." See Fritz Machlup, *An Economic Review of the Patent System*, Study of the Subcommittee on Patents, Trademarks and Copyrights of the Committee on the Judiciary, United States Senate, Eighty-fifth Congress, Second Session, (Washington DC: US Government Printing Office, 1958) at 80.

industry is generally longer than in electronics industry. Further, some argue that the technology-neutral approach of patent protection is creating imbalances between different patentable subject matters, or different industries and sectors, some of which are more important to meet people's basic human rights, such as human rights to health. Thus, patent requirements, both substantive and procedural, should adjust to particularities of technological fields.

Moreover, there are disparities in technological sophistication and economic maturity and, as a result, gaps in the distribution of patent ownership worldwide. Patent rights holders of inventions that attract licensing are disproportionally from developed countries.[158] It is generally agreed that the ideal level of patent protection varies from country to country and depends on the respective level of economic development. The ideal level of patent protection, represents the optimal balance between upstream and downstream innovators, as well as innovators and users from a public interest perspective, and generates a maximal level of innovation.

Second, the design of the patent system should balance long-term gain of the increased incentives for more innovation on the one hand, and short-run cost of pricing out some potential innovators and deadweight loss to society because of increased costs of producing future innovations, on the other.

Patent rights tend to raise the prices of innovative goods above their marginal cost of production, thereby excluding those who cannot afford monopoly prices. Due to its public

[158] In the 1990s, almost 90% of all of the royalties and licensing fees on a worldwide basis were received by five countries: the US (58%), Japan (10%), the UK (9%), Germany (6%), and France (4%). See Jörn Kleinert, *The Role of Multinational Enterprises in Globalization,* (Berlin: Springer, 2004) at 16, cited in Daniel C.K. Chow & Edward Lee, *International Intellectual Property: Problems, Cases, and Materials,* (St. Paul, MN: Thomson/West, 2006) at 12.

goods character, innovation can be made available simultaneously and repeatedly on a non-exclusive basis to multiple users at a low marginal cost. Therefore, from a social welfare viewpoint, it is not efficient to exclude innovation users and an innovation should reach the widest users possible in a perfectly competitive market. Put differently, strong patent monopoly creates static (short-run) inefficiencies and a deadweight loss to a society which may not be offset by the long-term benefits brought by new innovations. Moreover, the social cost of patent monopoly is very high because the existing innovation mechanisms build around profit maximization rather than public good provision. Corporate innovators are mandated to serve shareholders' profit-maximization interests rather than achieving valuable social goals, such as providing essential medicines to those who cannot afford them or investing in finding a cure for a rare disease that only inflicts the poor.

The scope and strength of private patent privilege should be limited by public interest in expanding human welfare and achieving social and ethical objectives. Patent rights only confer temporary monopolies of limited scope rather than unfettered rights of ownership or exclusion. Public interest may be invoked to override or restrict patent rights if a patent deters competition and results in exorbitant prices, impedes the dissemination of information and innovation, or in cases of national emergency or other extreme urgency. This is particularly important to developing countries where the proper regulatory and institutional framework of maintaining healthy competitive markets and providing public knowledge goods is underdeveloped. Further, law and policy makers, patent offices, and courts should uphold public interest through a careful scrutiny of the moral critieria and ethical dimensions of patent.

Third, the design of the patent system should account for the cumulative, collaborative, and user-centred innovation processes. The true nature of technological change is cumulative improvements based on collaborative efforts of people over time, rather than a flash of breakthrough genius of specific individuals.[159] Rochelle Dreyfuss notes:

> Knowledge production is a cumulative enterprise; the storehouse of information does not grow unless creators have the freedom to learn from, and build on, earlier work. Especially in sectors engaged in generating fundamental cultural and scientific advances that are traditionally sources of important spill-over benefits, the inability to control the rising costs of intellectual inputs is potentially chilling. Nor is it optimal for international agreements to freeze the law of innovation when the output and organization of creative enterprises change over time.[160]

Revolutionary inventions are rare.[161] Most inventions involve incremental improvement of existing products or production processes. Few inventors are not indebted to the pool of knowledge available to them. Few inventions are not inspired or informed by those that came before them. The chain of intellectual debts, grand and profound, is what sustains humanity and unites us as a species on the planet. Intellectual debts are not expected to be paid back, but are meant to carry forward by imparting on and adding to the public knowledge domain to the next generation. This altruistic act of guarding and giving back knowledge pertains to our intrinsic human nature. The relentless yet humble pursuit of however small a contribution an inventor could make to the continuous flux of knowledge is

[159] George Basalla, *The Evolution of Technology*, (Cambridge, UK: Cambridge University Press,1988).
[160] *Supra,* note 93 in chapter 2, at 22.
[161] Kitch contends that "in both the U.S. and Japanese patent systems, the vast majority of patents concern relatively trivial technological changes and do not confer any significant market advantage on their owners." See Edmund W. Kitch, "The Japanese Patent System and U.S. Innovators", (1997) 29 N.Y.U. J. Int'l L. & Pol. 177, at 181.

both a self-liberation of her intellectual existence and an ultimate service to her community.[162]

Individualized ownership and privatized property of intellectual production promote the commoditization of knowledge and commercialization of ideas. The patent system provides incentives for those innovations that tend to be commercialized and is insufficient to stimulate innovation that is not based on commercialization. End-users are important actors in innovation processes. They innovate not for proprietary interests, but for self-use.[163] For example, an innovative product can serve general purposes, but need adaption or adjustment to fit in specific circumstances. With emerging participatory technologies, innovator profiles have expanded from "a few specialized scientists inside research laboratories of companies or organizations" to include multiple actors.[164]

The goals of stimulating innovation and enhancing social welfare tend to be caught in conflicts. While patent monopoly provides incentives for innovation, promotes economic growth, and enhances social welfare, too much monopoly creates barriers to market entry and technology transfer, increases price for future innovation and social costs, and denies the public's access to the innovation commons.[165] The prevailing patent protection norm, according to Jerome Reichman, has changed from one in which patent rights represented "islands of protection in a sea of free competition" to "islands of competition in a sea of

[162] The premise of intellectual property laws, which are based on the idea that people need an incentive and/or reward to put their time and effort into inventing and creating and that they won't donate their time as a service to the community, runs counter to intrinsic human existence.
[163] Eric von Hippel & Chen Jin, "The Major Shift towards User-centred Innovation: Implications for China's Innovation Policymaking", (2008) 1 Journal of Knowledge-Based Innovation in China, at 16-27.
[164] At the launch of the Global Innovation Index 2012, WIPO Director General Francis Gurry pointed out that innovators now include "multiple actors, including governments, other nongovernmental organisations, and society as a whole." See *supra,* note 28 in chapter 4.
[165] See *supra,* note 47 in chapter 4.

legal monopolies."[166] The expanding scope of patent protection may diminish the public domain of knowledge, impede innovation, and cause what James Boyle called the "second enclosure movement".[167]

Therefore, an effectively functioning patent system requires a delicate balancing of the following key elements: (1) patentable subject matter (the scope of invention); (2) the standard of novelty that determines the threshold of inventiveness; (3) the standard of disclosure that ensures the scope of a patent must correspond to the scope of the disclosed knowledge; (4) the strength of the patent rights defined by the extent of limitations and exceptions to patent rights (such as compulsory licensing, research exemption, regulatory review exception, and government use exception, etc); (5) pre- and post-grant opposition procedures; (6) morality or *ordre public* objections; and (7) competition law.

In summary, the design of the patent system should aim to preserve the innovation commons and balance innovators' private interest in capturing financial rewards and the societal interests in broadening the innovation commons.

4.5 Conclusion

While designing the patent system and formulating patent policies, governments should balance the incentives for exercising one's intellect in innovative production provided by exclusive rights and the economic efficiency loss due to monopoly power in market

[166] Jerome H. Reichman, "Nurturing a Transnational System of Innovation" in Inge Govaere & Hanns Ullrich, eds., *Intellectual Property, Public Policy and International Trade*, (Brussels: P.I.E. Peter Lang, 2007) at 19.
[167] James Boyle, *The Public Domain: Enclosing the Commons of the Mind*, (New Haven, CT: Yale University Press, 2008). See also, James Boyle, "Fencing off Ideas: Enclosure and the Disappearance of the Public Domain", (2002) 131:2 Daedalus 13; James Boyle, "The Second Enclosure Movement and the Construction of the Public Domain" (2003) 66 Law & Contemp. Probs. 33.

competition.[168] In other words, the exclusive rights and economic incentives provided by patent protection to innovators should be sufficient to encourage innovation and disclose new technical information, but not too excessive to harm the innovation environment which is essential to sustainable innovation and social welfare.[169] In short, a strong patent system, in the absence of other social, economic, and legal factors, is insufficient on its own to spur innovation.[170]

[168] Arrow, "Economic Welfare and the Allocation of Resources for Invention", *supra,* note 38 in chapter 1; see also, Joseph E. Stiglitz, "Economic Foundations of Intellectual Property Rights", (2008) 57 Duke L. J. 1693, online:
<http://www2.gsb.columbia.edu/faculty/jstiglitz/download/papers/2008_Economic_Fdns_Int_Property.pdf>.
[169] Graham Dutfield, Lois Muraguri, & Florian Leverve, "Exploring the Flexibilities of TRIPS to Promote Biotechnology in Developing Countries", in Carlos M. Correa, ed., *Research Handbook on the Protection of Intellectual Property under WTO Rules*, (Cheltenham, UK: Edward Elgar, 2010) 540 at 545.
[170] Ha-Joon Chang analyzes various areas of economic and social regulation beyond intellectual property in innovation and industrial development. See Ha-Joon Chang, *Kicking Away the Ladder: Development Strategy in Historical Perspective,* (London: Anthem, 2003).

Chapter Five: TRIPS Patent Regime as Part of a Global Innovation System

This chapter develops a conceptual and institutional framework for integrating the TRIPS patent regime into a global innovation system. The new framework, as a normative yardstick and an analytical tool, guides the interpretation, implementation, and future development of the TRIPS patent regime.

In essence, a global innovation system should aim to ensure substantive equality of innovation capability of the world population and their freedom to innovate by coordinating, steering, and facilitating the flow of innovation resources towards a desirable combination of different innovation systems. It balances the patent system and non-proprietary innovation systems to a desirable ratio in order to produce the highest attainable innovation efficiency, productivity, and social utility.[1] My hypothesis is that since the entry into force of the TRIPS patent provisions and their implementation by WTO Members, the balance between the proprietary and non-proprietary systems of innovation promotion has been tilting towards the patent system, thus generating an imbalance between the two types of innovation incentives. This tilt toward the patent system causes imbalances between different innovation promotion systems which adversely affects developing countries more than developed ones in the pursuit of sustainable environmental, economic, and social development, especially in the areas of access to medicines and educational materials, the misappropriation of traditional knowledge and threatenting of traditional farming practices, and restrictive technology licensing practices.

[1] Andrew W. Torrance & Bill Tomlinson, "Patents and the Regress of Useful Arts" (2009) 10 Colum. Sci. & Tech. L. Rev. 130.

The imbalance challenges the legitimacy and effectiveness of TRIPS in fulfilling its mandates, and in turn TRIPS risks losing credibility and relevance. Thus, a reconstruction of innovation incentives is needed to promote technological innovation and distribute informational welfare. I argue that a fair and balanced global innovation system should secure "the freedom to innovate" for the world citizens by providing them with equal opportunity to cultivate their innovation capabilities and eliminating barriers to exercise their innovation capabilities. A fair and balanced global innovation system should enable everyone to have at least the basic innovation capability and freedom to exercise her intellect in innovation production and receive adequate compensation that is fair to their investments while preserving their intellectual dignity and moral rights. Financial reward is a popular type of compensation. An innovator should nevertheless be free to choose any compensatory mechanism he prefers or forego his compensation altogether if he so desires. The fulfillment of one's needs or duties, enhancement of one's own or community reputation, promotion of one's personally important social objective or utility, and pursuit of pleasure and enjoyment, can all be fair compensation for one's innovation.

This chapter is organized into five sections. Section One examines the globalization of innovation paradigm, as the patent system evolved from an exception to monopoly under the 1623 *Statute of Monopolies*, to an increasingly harmonized global system of universal minimum protection. The historical evolution shows the shrinking legal flexibilities and policy space in the international patent regime and the increasing linkage between patents and international trade. In particular, the advent of the TRIPS Agreement denies developing countries legal flexibility and policy space that industrial countries had throughout the formative stage of their industrialization.

Section Two presents the origin and main features of the TRIPS patent regime and the impacts of its neoliberal approach and market fundamentalism on innovation capability. It argues that the TRIPS negotiating history signals the ultimate triumph of economic and political liberalism, while its salient features prove that overprotective patent protection may be suboptimal to provide innovation incentives and promote development. Further, it analyzes the limitation of TRIPS as a pre-Internet instrument to account for the dynamics of innovation systems.

Section Three examines the five main problems that have caused the underperformance of the TRIPS patent regime in enhancing innovation capability in both developing and developed countries. First, the one-size-fits-all approach does not account for the differences of development levels and characters of technological fields and consequently causes inequality of innovation opportunity in different countries and technological fields. Second, it relies on patent incentives to promote innovation and ignores the dynamic roles of governmental measures and alternative innovation models in incentivizing innovation. Third, the widening scope of patentable subject matter and strengthening of the patent rights restrict the public access to a vibrant innovation commons and hence stifle future innovation. Fourth, it limits Members' abilities to design a patent system that is suitable for its entrepreneurial culture and thus does not honor the dignity of entrepreneurial spirit. Fifth, the seller-oriented mass market TRIPS regime of innovation promotion is not compatible with indigenous innovation which is inherited from past generations and gradually improved through collective ingenuity and informal, communal, grassroot innovative practices.

Section Four sketches the key instruments and institutions undergirding the international framework for cultivating innovation capability and extracting value from new and useful processes, products, and services. And lastly, Section Five calls for the integration of the TRIPS patent regime into a fair and balanced global innovation system to ensure substantive equality of innovation capability of the world population and their freedom to innovate.

5.1 The Globalization of the Innovation Paradigm

The globalization of the innovation paradigm is parallel to and affected by the interrnalization of the patent regime. The international patent system refers broadly to the system of international patent treaties and legal institutions that facilitate the acquisition, licensing, assignment, and enforcement of patent rights. International patent treaties lie at the intersection of public and private rights as well as international and national domains. They are negotiated by national governments, administered by multilateral bodies, implemented in national law, enforced through international dispute mechanisms, and abided by private economic actors. It should be noted that there is no such thing as an "international patent" because patent rights are governed by patent laws of the country which grants the patent.[2] The principle of territoriality essentially means one can only obtain and exercise her patent rights in accordance with the substantive and procedural criteria prescribed by the patent law of the country where she applies for a patent. The territorial limitation of patent law also means a patentee has no remedial recourse against patent infringement performed beyond the border of the country which grants her the patent.

[2] The Patent Cooperation Treaty allows an international application to be filed under a unified procedure.

This section traces back to the historical origin of the patent system and its evolvement through three phases: the national phase, the multilateral phase, and the global trading phase.[3] It argues that with the gradual internationalization of the patent regime and its increasing linkage with the global trading system, governments' legal flexibility and policy space to design their patent laws and policies and build their technological and industrial bases has been restricted. In particular, the TRIPS patent regime is in contrast to the historical development of patent law and the natural advancement of economies. Successful development experience indicates that the strength of patent protection and the level of technological and economic development are positively correlated. Countries only increase their strength of patent protection gradually according to their development levels. The compatibility of the level and scope of patent protection with the national economic and industrial conditions is the key for the optimal functioning of any patent system. The overprotective patent protection may be suboptimal to provide innovation incentives and promote development.

5.1.1 The Patent System at the National Stage

The underlying features of patent protection at the national stage were maximum legal flexibility and policy space, as well as the gradual increase of the level of patent protection with the economic and social development. Patent systems were based entirely on national standards shaped by public policy and national interests for the purpose of transferring technology and encouraging investment to build an industrial base.[4] Public

[3] John Braithwaite and Peter Drahos divide the history of intellectual property into three distinct periods: the territorial period, the international period, and the global period. See John Braithwaite & Peter Drahos, *Global Business Regulation*, (Cambridge: Cambridge University Press, 2000) at 57-63.

[4] Thomas M. Meshbesher argues that differences in national patent laws "may owe considerably more to different approaches to the public-policy underpinnings of patent law than to differences in the character of

interest was safeguarded through such measures as the disclosure requirement and obligation to work the patent. Hence, national patent laws are the utmost reflection of national priorities in technological and economic development.

The origin of patent law can be traced back to the guild monopoly of technological know-how and the royal prerogative grant of privilege that existed in most of medieval Europe.[5] The first patent statute in the world, *Statute of Venice*, was codified in Venice in 1474.[6] Patents were granted by the state to encourage invention and immigration into Venice of "genius men".[7] Patent law and practice gradually spread throughout France, Germany, Holland, Belgium, and finally reached England, where the landmark *Statute of Monopolies* was enacted in 1623.

In England, the patent system was introduced to acquire superior foreign technologies, develop new industries and encourage economic self-sufficiency. The monopoly privilege was provided on condition that the patentee should introduce the new industry into the country by working the imported invention and teaching it to the public.

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legal thought of judges and legislators operating under different legal systems." See Thomas M. Meshbesher, "The Role of History in Comparative Patent Law", (1996) 78 J. Pat. & Trademark Off. Soc'y 594 at 596-597.

[5] Peter Drahos, "The Universality of Intellectual Property Rights: Origins and Development," available online: WIPO: <http://www.wipo.int/tk/en/hr/paneldiscussion/papers/pdf/drahos.pdf>.

[6] The text of *Statute of Venice* can be found in Archivio di Stato, Venezia: *Senato Terra*, Reg. 7, c. 32. In this research, I have located five different versions of its English translation in contemporary legal scholarship. Nevertheless, I find that minor differences in translation do not discount the establishment of the meaning of the statute. See examples of English translation in: Jeremy Phillips, "The English Patent as a Reward for Invention: The Importation of an Idea", (1982) 3:1 J. Legal Hist. 71 at 75–76; Maximilian Frumkin, "The Early History of Patents for Inventions", (1947) 26 Transactions of the Newcomen Society 47 at 49; Stephen P. Ladas, *Patents, Trademarks and Related Rights: National and International Protection,* (Cambridge, MA: Harvard University Press, 1975); Giulio Mandich, "Venetian Patents (1450-1550)", (1948) 30 J. Pat. Off. Soc'y 166; and Vishwas Devaiah, *A History of Patent Law,* online: Alternative Law Forum <http://www.altlawforum.org/intellectual-property/publications/a-history-of-patent-law> (last visited 31 December 2009).

[7] Thomas M. Meshbesher posits that the preamble of the Venetian patent statute contains "a governmental policy: encouraging invention by making it unprofitable for infringers to copy the invention and take the inventor's honor away." Thomas M. Meshbesher, "The Role of History in Comparative Patent Law" (1996) 78 J. Pat. & Trademark Off. Soc'y 594 at 605.

Subsequently, the patent monopolies became abusive under the monarchs of Elizabeth I and James I. The 1623 *Statute of Monopolies* was enacted to invalidate all monopolies granted prior to that date, and prohibit the grant of monopolies except for "the true and first inventor or inventors" of "any manner of new manufacturers within this realm." Section 6 of the *Statute of Monopolies*, entitled "Proviso for future Patents for 14 Years or less, for new Inventions," laid down the provisions of modern patent law as follows:

> "Provided also that any declaration before mentioned shall not extend to any letters patent and grant of privilege for the term of fourteen years or under, hereafter to be made, of the sole working or making of any manner of new manufactures within this realm, to the true and first inventor and inventors of such manufactures, which others at the time of making such letters patent and grants shall not use, so as also they not be contrary to the law or mischievous to the state, by raising prices of commodities at home, or hurt of trade or generally inconvenient."[8]

I argue that rather than to confer on an inventor an inherent right to a patent for his invention, the *Statute of Monopolies* was "an instrument of economic policy" to prohibit monopolies and "encourage industry, employment and growth".[9] The patentee was obliged to work his invention in the country for a specific time,[10] and teach the details of his inventions to indigenous apprentices so that at the end of the patent term the arts could be substantially used by Englishman.[11]

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[8] Cited in Sir William Jarratt, "English Patent System" (1944) 26 J. Pat. Off. Soc'y 761, at 761.

[9] John N. Adams, "History of the Patent System" in Toshiko Takenaka, ed., *Patent Law and Theory: A Handbook of Contemporary Research*, (Cheltenham, UK: Edward Elgar, 2009) ft 11 at 103. Peter Drahos notes as well that the Statute is "a straight piece of economic policy". See Peter Drahos, *A Philosophy of Intellectual Property* (Aldershot; Brookfield, USA: Dartmouth, 1996) at 32.

[10] It has been suggested that the period of grant for patents was set according to the length of apprenticeships, i.e., 14 year period equated to the training of two generations of apprentices. See Philip W. Grubb, *Patents for Chemicals, Pharmaceuticals and Biotechnology: Fundamentals of Global Law, Practice and Strategy*, 4th ed., (Oxford, UK: Oxford University Press), at 6.

[11] William Cunningham, "The Growth of English Industry and Commerce in Modern Times (Cambridge, UK: Cambridge University Press, 1915-1921) vol. II at 53-84. It should be noted that in the early eighteenth century, the condition for disclosure changed from the working of the invention to describing it by a written specification.

In the US and France, the first patent laws were enacted in 1790 and 1791 respectively. Apart from the recognition of the inventor's right, the first US *Patent Act* was intended to promote inventive activities for the progress of science and useful arts in accordance with the US Constitution, which declares that "the Congress shall have power … to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries." The 1787 US Constitution provided constitutional instrument affirmatively recognizing an individual's right in his intellectual creation. The Constitution declares that "the Congress shall have power … to promote the progress of science and useful arts, by securing for limited times to authors and inventors, the exclusive rights to their respective writings and discoveries."[12]

France became the first and only country to enact a patent statute providing a "property right" in invention as of natural right.[13] The 1791 French patent law was enacted on the basis that an inventor has a natural, inherent property right in his invention, which was "one of the fundamental rights of man".[14] This statute provided: "The National Assembly, considering that any new idea, the manifestation or development of which may become useful to society, belongs basically to the one who has conceived it, and that it would be a violation of the Rights of Man, in their essence, not to regard an industrial discovery as property of its

[12] Malla Pollack, "What Is Congress Supposed to Promote? Defining 'Progress" in Article I, Section 8, Clause 8 of the U.S. Constitution, or Introducing the Progress Clause" (2002) 80 Nebraska L. Rev. 754.
[13] Edward C. Walterscheid, "The Early Evolution of the United States Patent Law: Antecedents (Part I)" (1994) 76 J.P.T.O.S 697, fn 10 at 699.
[14] The preamble stated that "every novel idea whose realization or development can become useful to society belongs primarily to him who conceived it, and it would be a violation of the rights of man in their very essence if an industrial invention were not regarded as the property of its creator."

author…decrees as follows: 1. Any discovery or new invention, in any kind of industry, is the property of its author."[15]

After the *Statute of Monopolies* was adopted in England, the systematic use of monopoly privileges for inventors gradually spread to other countries. With the enactment of *modern* patent legislation in the US in 1836,[16] and in the UK in 1852,[17] a *modern* patent legal system gradually took shape and started to function as a sophisticated social-legal construct that regulated and institutionalized the interactions between and among technological knowledge, legal rights, and commercial exchanges. By the end of the 19th century several of the present developed countries established their own national patent laws to encourage and reward the invention of new technology.

The historical perspective of patent rights favours *reasonable* exploitation of a temporary monopoly and a *moderate* degree of protection which is aligned with the specific combination of social conditions. After all, intellectual property law in general has always been treated as an exception to the dominant legal doctrines in favour of economic

[15] Frank D. Prager, "A History of Intellectual Property from 1545 to 1787", (1944) 26 J.P.O.S. 711, at 756-757.
[16] The US Patent Act of 1836, ch. 357, 5 Stat. 117-25, is generally recognized as the first modern patent law in the US. See Anthony William Deller, "The United States Patent System" in Felix Liebesny, ed., *Mainly on Patents: The Use of Industrial Property and its Literature* (Hamden, Conn.: Archon Books, 1972) 47 at 48: "Basically, the 1836 Patent Act founded the modern American patent system." See also Frank D. Prager, "Trends and Developments in American Patent Law from Jefferson to Clifford (1790-1870) Part II," (1962) 6:1 Am. J. Legal Hist. 45 at 52; Oren Bracha, "The Commodification of Patents 1600-1836: How Patents Became Rights and Why We Should Care" (2005) 38 Loy. L.A. L. Rev. 177 at 235-239.
[17] The *Patent Law Amendment Act, 1852* (U.K.), 15 & 16 Vict., c. 83. The Patent Act of 1852 recognized the patent grant as a reward for inventive activity for the first time; established one uniform patent system and examination procedures throughout the UK; established the Patent Office; and cut out most of the circuitous ten-stage procedure involving multiple government offices. See Edward Armitage, "Two Hundred Years of English Patent Law" in American Bar Association, *Two Hundred Years of English and American Patent, Trademark, and Copyright Law: Papers Delivered at the Bicentennial Symposium of the Section of Patent, Trademark, and Copyright Law Annual Meeting*, Atlanta, Georgia, August 9, 1976 (Chicago: American Bar Center, 1977) 3 at 15. See more on 1852 patent reforms in William Martin, *The English Patent System* (London: J. M. Dent & Co., 1904) at 22; and Simon Thorley *et al*., *Terrell on the Law of Patents*, 16th ed. (London: UK, Sweet & Maxwell, 2006) at 6.

autonomy, freedom of expression and ideas, and political tolerance.[18] Furthermore, some European countries chose not to rely on the patent system to promote innovation, but rather engaged in "bold institutional experimentation" with their innovation systems because there were no international constraints such as TRIPS.[19] For example, the Netherlands and Switzerland were without a national patent system for several decades during a period of rapid technological innovation and industrialization. The Netherlands, which in 1869 repealed its patent law of 1817, did not reintroduce a patent system until 1912,[20] whereas Switzerland, which introduced its first patent law, an extremely rudimentary one, in 1888, did not have a comprehensive patent system until 1907.[21] Therefore, TRIPS represents a departure in the history of intellectual property law from a reasonably balanced level of protection and incremental increase in the scope and strength of patents.

5.1.2 The Multilateral Stage—The Paris Convention

The multilateral stage of patent protection started with the conclusion of the Paris Convention and was characterized by rapid industrialization, technological innovation, the

[18] Since the "Age of Enlightenment" in the late 18th Century, monopolies have been principally considered bad for the economy and intellectual property was considered a limited exception. See, for example, the EU Commission's review of the Single Market highlighted "the need to promote free movement of knowledge and innovation as the 'Fifth Freedom' in the single market." EU Commission, *A Single Market for 21st Century Europe*, COM (2007) 724 final of November 20, 2007. This is again emphasized in the EU Commission's Green Paper on Copyright in the Knowledge Economy, COM (2008) 466/3, at 3, available <http://ec.europa.eu/internal_market/copyright/docs/copyright-infso/greenpaper_en.pdf>. Moy summarized the international effects of patents as follows: "Patent systems are large-scale governmental intrusions into the free-market economy. They involve manipulating social costs and benefits to increase the national wealth. Perhaps the most significant cost of such systems is the higher prices imposed on consumers of the patented advance…" R. Carl Moy, "The History of the Patent Harmonization Treaty: Economic Self-Interest as an Influence" (1993) 26 J. Marshall L. Rev. 457, at 481.

[19] Peter Drahos, "The US, China and the G-77 in the Era of Responsive Patentability," Queen Mary School of Law Legal Studies Research Paper No. 105/2012, online available: SSRN <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2022874> at 3.

[20] G. Doorman, "Patent Law in the Netherlands: Suspended in 1869 and Reestablished in 1910," Part I, (1948) 30:3 Journal of the Patent Office Society 225.

[21] Eric Schiff, *Industrialization without National Patents: The Netherlands, 1869-1912, Switzerland, 1850-1907*, (Princeton, N.J.: Princeton University Press, 1971) at 93.

expansion of international commerce, uneven development of countries, and the emergence of two competing ideologies – free trade and protectionism.[22] The Paris Convention provides national treatment and minimum international standards with lax enforcement and dispute settlement mechanisms, leaving members significant policy space to adopt their own patent law and policy based on utilitarian and independent assessment of their own economic self-interests. I will make three principle arguments with respect to the negotiation and main features of the Paris Convention.

First, the standard of patent protection has been progressively increasing with each revision conference of the Paris Convention, but at a relatively slow pace and supported by political consensus and policy flexibility. As to the general trend of patent protection, patent rights had been constantly strengthened and patent scope extended with each major revision. However, these progressive changes were incremental during a long period of several decades. As Beier notes: "The improvement of international protection was accomplished gradually, without haste, in the natural interplay between national and international legal developments."[23] The incremental changes throughout the late nineteenth and early twentieth century gave countries time to "structure, develop, strengthen and diversify their technological and industrial, as well as human, capacities."[24] It should also be noted that the

[22] Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (New York: Oxford University Press, 1990) at 113-148.
[23] Friedrich-Karl Beier, "The Role of the Paris Convention", at 13.
[24] Ituku Elangi Botoy, "From the Paris Convention to the TRIPS Agreement: A One-Hundred-and-Twelve-Year Transitional Period for the Industrialized Countries" (2004) 7:1 Journal of World Intellectual Property 115 at 115.

progressive approach is a universal norm not only in the harmonization of intellectual property protection, but also in multilateral trade.[25]

In addition, these progressive changes tended to happen from the bottom-up and were accepted with political consensus. In other words, new rights, norms, or subject matters emerged first at the national level. Only upon favourable experimental outcomes in multiple countries would these new changes be discussed and codified at the international level. Gervais highlights the voluntary nature of international patent treaty-making when he writes, "international intellectual property norms developed slowly from the basic concept of national treatment through the progressive codification of new rights or protection of new subject matter only when a sufficient number of like-minded countries were prepared to enter into international agreement for that purpose."[26] This stands in sharp contrast to the top-down TRIPS lawmaking, which states, "domestic IP rules and standards are primarily shaped and defined at the international level. In many respects national IP legislation implements what has been internationally agreed."[27]

Furthermore, the Paris Convention does not prescribe mandatory standards of national patent protection and leaves significant flexibility for local adaptation and interpretation. Instead, it mainly addresses the following issues: national treatment of foreign rights holders, rights of priority, general principles and minimum standards of protection for

[25] Thomas Cottier notes that: "progressive liberalization of goods has taken decades, and not years." See, Thomas Cottier, "The Agreement on Trade-Related Aspects of Intellectual Property Rights" in Patrick F. J. Macrory, Arthur E. Appleton & Michael G. Plummer, eds., *The World Trade Organization: Legal, Economic and Political Analysis*, (New York: Springer, 2005), vol.1, 1041 at 1045 [Thomas Cottier, "The TRIPS Agreement"].

[26] Daniel J. Gervais, "The Internationalization of Intellectual Property: New Challenges from the Very Old and the Very New", (2002) 12 Fordham Intell. Prop. Media & Ent. L. J. 929, at 938–939 [Gervais, "The Internalization of Intellectual Property"].

[27] Thomas Cottier, "The TRIPS Agreement", *supra* note 25 in chapter 5, at 1050.

patents and trademarks, a venue for multilateral negotiations, as well as an international bureau for administrative tasks. In fact, it is "improbable that the Paris Convention would ever have been adopted by countries which were at widely varying stages of development at that time if the convention had not permitted such freedom to their members."[28] Hence, countries were free to establish their own laws and regulations based on their national interests and needs.[29] Members are left with significant flexibilities to determine patentable subject matter exemptions; patentability criteria; patent term; scope of substantive rights; and exceptions and limitations to such rights.[30]

To conclude the first argument, the Paris Convention gradually increases international patent standards supported by political consensus and policy flexibility, but this tradition has been betrayed by the limited transition period and coercive manner of the TRIPS Agreement.

My second argument with respect to the negotiation and main features of the Paris Convention is to say that economic self-interests in protecting innovative domestic industries have been the main motivation for countries to accede to the Paris Convention, as well as to advocate for certain rules. In other words, national patent policy is made on the basis of national welfare considerations. There are ample examples of tensions even among like-

[28] Rajan Dhanjee & Laurence Boisson de Chazournes, "Trade Related Aspects of Intellectual Property Rights (TRIPS): Objectives, Approaches and Basic Principles of the GATT and of Intellectual Property Conventions," (1990) 24:5 Journal of World Trade 5 at 7.

[29] Peter Yu observes: "Although some countries preferred to have greater harmonization—or even universal standards—others declined and insisted on reserving a considerable amount of sovereign discretion in the Conventions." Peter K. Yu, "The Global Intellectual Property Order and Its Undetermined Future" (2009) 1 WIPO Journal. See also, Bodenhausen, at 15.

[30] Bodenhausen observes that: "the Convention leaves the member States entirely free to establish the criteria for patentability, to decide whether patent applications should or should not be examined in order to determine, before a patent is granted, whether these criteria have been met, whether the patent should be granted to the first inventor or to the first applicant for a patent, or whether patents should be granted for products only, for processes only, or for both, and in which fields of industry and for what term." See Bodenhausen, *Guide to the Paris Convention*, *supra* note 4 in chapter 1, at 15.

minded trading partners with respect to substantive standards and scope of exceptions. Their disagreements largely stem from different economic incentives and interests. For example, when the US was a net importer of technology, it ignored foreign patent rights and restrictions on technology exports. Only when its economy and technology advanced to such a level that stronger patent protection became beneficial to its own industries did it start to push for stronger international patent standards. Similarly, it was because Germany had comparative advantages in dye stuff and chemical industries that it was at the forefront of arguing against compulsory working requirements.[31]

Another good case in point is Switzerland's experience with the Paris Convention. Patent laws were rejected by popular referenda in 1866 and 1882 when Switzerland was an importer of technology.[32] Despite the fact that it had never had a patent law by the time of the Paris Convention, Switzerland participated actively and was one of the original signatories. The Swiss industries, especially the watch industry, grew to become competitive exporters of technology and saw patent protection imperative.[33] A patent law passed overwhelmingly by referendum in 1887, but it did not protect chemical inventions so that the Swiss industry could continue to use chemical technology developed by the more advanced Germans.[34] It was not until 1907 when the German Reich threatened tariff retaliation that the

[31] Graham Dutfield, *Intellectual Property Rights & The Life Science Industries: Past, Present & Future*, 2nd ed., (London: World Scientific, 2009).
[32] Dominique S. Ritter, "Switzerland's Patent Law History", (2004) 14 Fordham Intell. Prop. Media & Ent. L.J. 463.
[33] *Ibid*.
[34] Nathan E. Stacy, "The Efficacy and Fairness of Current Sanctions in Effecting Stronger Patent Rights in Developing Countries," (2005) 12 Tulsa. J. Comp. & Int'l L. 263.

Swiss patent protection applied to chemical and pharmaceutical inventions.[35] Even then, the Swiss patent law protected only chemical process technology and not chemical compounds.

To conclude the second argument, the minimum standards embodied in the Paris Convention reflect a compromise among developed countries after reconciling their respective economic self-interests, while developing countries did not play any effective role in the formative period of the Paris Convention.

Third, the modest goal of the Paris Convention to establish minimum international standards of patent protection is further curtailed by its ineffective enforcement and dispute settlement mechanisms. The Paris and Berne Conventions have been "to a great extent more honoured in their breach than in their observance."[36] The 1925 proposal of submitting disputes to the Permanent Court of International Justice (the predecessor to the International Court of Justice) was opposed by the United States. It was not until 1967 that it was possible to refer disputes between states to the International Court of Justice (ICJ).[37] However, this dispute settlement procedure remains a remote theoretical possibility largely because the jurisdiction of the ICJ is not mandatory, but rather depends on states' consent.[38]

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[35] Richard Gerster, "Switzerland and the Revision of the Paris Convention", (1981) 15 Journal of World Trade Law 111.

[36] Hugh Brett, "Book Review" (1999) 21:5 E.I.P.R. 269 at 269.

[37] According to Article 28(1) of the revision act, any dispute between two or more countries of the Union concerning the interpretation or application of the Convention, and not settled by negotiation, may, by any one of the countries concerned, be brought before the International Court of Justice (ICJ) by application in conformity with the Statute of the Court, unless the countries concerned agree on some other method of settlement.

[38] Frank Emmert analyzes the difficulties within the ICJ procedure: "First of all, while its judges have an excellent reputation as independent, nonpartisan international lawyers, the ICJ has no expertise in matters of IP. Secondly, the majority of the member states of the convention never accepted the compulsory jurisdiction of the ICJ in IP matters, and thus cannot be sued before it against their will. Last but not least, even those states that do accept its jurisdiction have never sued one another before the ICJ. There has not been a single proceeding since 1967 because patent disputes were considered to be too trivial to bring before the ICJ. Moreover, such a suit would be considered an unfriendly act against the defendant state. As long as these problems are not addressed by WIPO, the dispute settlement is effectively worthless." See Frank Emmert,

It can be drawn from the above discussion that the Paris Convention is the precursor of the modern international patent system and continues to serve as a systematic framework for the international protection of industrial property. Although the Paris Convention establishes minimum substantive standards for patents, it leaves significant flexibility for local modification and interpretation, which is to be substantially curtailed with the advent of the TRIPS Agreement. These flexibilities and the lack of effective enforcement and dispute settlement mechanisms have helped countries develop national patent laws according to their level of industrialization and build technological and industrial bases.

5.1.3 The Global Trading Stage—The TRIPS Agreement

The globalization of the international patent regime accentuated through the multilateral trading system and influenced profoundly the global innovation paradigm. The primary forum for intellectual property law-making and norm-setting shifted from the WIPO to the WTO in the early 1980s. In addition to the deficits of patent protection under the traditional framework, the increasing economic significance of patents and "the questionable nature of unilateral and bilateral protection alternatives" are another two reasons for intellectual property protection being included in the GATT negotiations.[39] The TRIPS Agreement was negotiated in a global trade context with a view to ameliorating trade barriers and deregulating global economy. The TRIPS negotiating history shows that the

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"Intellectual Property in the Uruguay Round—Negotiating Strategies of the Western Industrialized Countries", (1989) 11 Mich. J. Int'l. L. 1317 at 1343. As well, Jerome Reichman notes that general international law doctrine has never been invoked to enforce intellectual property law: "no state invoked the doctrine of retaliation and retorsion under public international law, as a state could have done if it believed another country was in violation of its treaty obligation."See Jerome H. Reichman, "Enforcing the Enforcement Procedures of the TRIPS Agreement", (1997) 37 Va. J. Int'l L. 335, footnote 17 at 339.

[39] Paul Katzenberger & Annette Kur, "TRIPs and Intellectual Property", in Friedrich-Karl Beier & Gerhard Schricker, eds., *From GATT to TRIPs—The Agreement on Trade-Related Aspects of Intellectual Property Rights*, (Weinheim: VCH, 1996), at 7. [Beier & Schricker, *From GATT to TRIPS*]

TRIPS Agreement departs from the bottom-up, flexible, consensual lawmaking tradition developed during the the Bureaux Internationaux Réunis pour la Protection de la Propriété Intellectuelle ("BIRPI") phase,[40] and opens a new frontier of top-down, rigid, coercive lawmaking.

A number of observations can be drawn from the TRIPS negotiations. First, although the TRIPS negotiation involved relatively more input from developing countries than the Paris Convention, [41] the increased participation of developing countries did not fundamentally change the asymmetric and imbalanced process of intellectual property law-making.[42] This lack of negotiating power is evident in the fact that the majority of discussion centered on reconciling differences between the United States, Europe, and Japan rather than attending to the concerns of developing countries.[43]

Second, TRIPS should be viewed as both a compromise and as part of a broader package. Developing countries finally signed on to TRIPS thanks to the single undertaking rule which required the acceptance of one complete package of agreements by anyone who wanted to be a WTO member. In other words, "nothing is finally agreed until everything is

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[40] Daniel Gervais divides the internationalization of intellectual property protection into four phases: the bilateral phase (pre-1883); the "BIRPI " phase (1883–1971); the "TRIPS" phase (1971–1994); and the paradigmatic phase (1994–today). See Gervais, "The Internalization of Intellectual Property", at 933–949. The BIRPI phase involved the conclusion of two treaties: the *Paris Convention* in 1883 and the *Berne Convention* in 1886. The two international Bureaux set up to administer the Paris and Berne Conventions united in 1893 to form the United International Bureaux for the Protection of Intellectual Property, or the Bureaux Internationaux Réunis pour la Protection de la Propriété Intellectuelle ("BIRPI"). The BIRPI is the predecessor of the WIPO, which came into existence in 1967 and became a United Nations specialized agency in 1974.

[41] Daniel Gervais, "Internalization of Intellectual Property", at 942.

[42] Christopher Wadlow describes the design of TRIPS as "a North–South war of words, in which the North wrote the terms of the South's surrender, but the detail is generally the result of a North–North compromise, in which the parties were much more evenly balanced." Christopher Wadlow, "TRIPS: A View from behind the Scenes" (2009) 4:10 Journal of Intellectual Property Law & Practice 761 at 762.

[43] "…much of the debate and negotiations pitted the developed countries against each other on specific issues—U.S. vs. Japan on rental rights, EC v. U.S. and others on appellations of origin, Japan/EC vs. U.S. on patent law, U.S. v. EC on films." See Ross & Wasserman, "Trade-Related Aspects of Intellectual Property", at 2313.

agreed." Therefore, developing countries were promised increased market access to developed countries for agricultural and textile in exchange for intellectual property concessions.[44] As Friedl Weiss notes, the GATT provides a forum for the "accommodation of interests rather than of vindication of rights in a victory versus defeat pattern."[45]

The TRIPS negotiating history demonstrates that using a trade agreement to assist in the protection and enforcement of intellectual property rights was essentially lobbied by a few American, EU, and Japanese multinationals as a means of securing their market lead in the world economy. Two senior US government officials stated that "…the TRIPS Agreement is one of the central achievements of the Uruguay Round for the United States because intellectual property is one of this nation's greatest competitive advantages."[46] Concessions to developing countries are contained in Articles 7 and 8, as well as provisions on the transitional period and transfer of technology. Developing countries eventually signed on to the TRIPS Agreement due to: (1) the importance of intellectual property protection to attract foreign direct investment and technology transfer; (2) the advantage of the multilateral rule-based system over unilateral pressure;[47] (3) the exchange for better market access conditions for agriculture and textiles; and (4) their lack of knowledge of intellectual

[44] Jerome H. Reichman, "The TRIPS Component of the GATT's Uruguay Round: Competitive Prospects for Intellectual Property Owners in an Integrated World Market", (1993) 4 Fordham Intell. Prop. Media & Ent. L. J. 171 at 178; Christopher May, *The Global Political Economy of Intellectual Property Rights: The New Enclosures*, (New York: Routledge, 2010).

[45] Friedl Weiss, "TRIPS in Search of an Itinerary: Trade Related Intellectual Property Rights and the Uruguay Round Negotiations", in Giorgio Sacerdoti, ed., *Liberalization of Services and Intellectual Property in the Uruguay Round*, (Fribourg: University Press, 1990), at 107.

[46] See Peter N. Fowler & Alice T. Zalik, "A U.S. Government Perspective Concerning the Agreement on the Trade-related Aspects of Intellectual Property: Past, Present and Near Future" (2003) 17 St. John's J. Legal Comment. 401, at 402.

[47] Ted L. McDorman, "Unilateralism (Section 301) to Multilateralism (GATT): Settlement of International Intellectual Property Disputes After the Uruguay Round", in George R. Stewart, Myra J. Tawfik & Maureen Irish, ed., *International Trade and Intellectual Property: The Search for a Balanced System*, (Boulder: Westview Press, 1994) (discussing the decline in unilateralism that should occur after TRIPS is adopted along with the adjudicative, multilateral model of dispute settlement).

property rights and lack of negotiating power.[48] The comprehensive coverage of almost all major subject areas and the multilateral rules on enforcement and dispute settlement have surely made the TRIPS Agreement one of the chief accomplishments of the Uruguay Round. However, as I will show below, TRIPS does not necessarily create a socially optimal system.[49]

The TRIPS Agreement represents the ultimate triumph of economic and political liberalism and echoes themes of the "market fundamentalism" which has dominated and endangered the global capitalist system.[50] By unifying patent norms and standards and restricting patent flexibilities, TRIPS expands patent rights beyond the optimal level to provide innovation incentives and promote development. In essence, the TRIPS Agreement has not realized its full potential to promote innovation and development, as could have been reached if the five principles of a fair and balanced global innovation system were to be adopted.

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[48] Thomas Cottier observes that this does not apply to a strong group of developing countries, including Brazil and India, who "resolutely defended their interests". See Thomas Cottier, "The TRIPS Agreement", *supra* note 25 in chapter 5, at 1056.

[49] TRIPS is "not designed to give us a global system that comes anywhere near a socially optimum system." See, P. M. Gerhart, "Why Lawmaking for Global Intellectual Property is Unbalanced?" (2000) 22 European Intellectual Property Review 309.

[50] "Market fundamentalism" might be defined as "the idea that markets are a priori the solution to all problems, without taking into account the defects that sometimes (not always, but sometimes) beset market." Joseph E. Stiglitz, *Globalization and its Discontents*, (London: Penguin, 2002) at 35, 73-74. Market fundamentalists believe "that markets by themselves lead to economic efficiency, that economic policies should focus on efficiency, and that distributional concerns could and should be taken care of elsewhere in the political process." See Joseph E. Stiglitz, "Is There a Pose-Washington Consensus Consensus?" in Narcís Serra & Joseph E. Stiglitz, eds., *The Washington Consensus Reconsidered: Towards a New Global Governance*, (Oxford, UK: Oxford University Press, 2008) 41 at 46. Stiglitz posits that "market failures are pervasive, especially in developing countries rife with imperfections in information, limitations in competition, and incomplete markets." See also, Thomas F. Cotter, "Market Fundamentalism and the TRIPS Agreement", (2005) 22 Cardozo Arts & Ent. L.J. 307 at 309; and George Soros, *The Crisis of Global Capitalism: Open Society Endangered*, (New York: Public Affairs, 1998).

5.2 The TRIPS Regime of Innovation Promotion

The TRIPS Agreement not only inherits a century-long tradition of affording multilateral legal protection to the fruits of human intelligence, be it artistic creation or technological invention, but it also gives birth to the most comprehensive and effective legal regime of intellectual property rights within a global trade framework. In a sense, the TRIPS Agreement revolutionizes the legal regimes of both international trade and international intellectual property protection.[51]

As to the revolution of international trade regime, the WTO expands its regulatory competency from the confines of trade in goods to services and intellectual property rights.[52] WTO rules have gone beyond traditional border measures, such as tariffs and quantitative restrictions, and have extended to national regulatory regimes, which are an essential part of a sovereign's power in making domestic policies (e.g., environmental and labour standards) and regulating economic affairs (e.g., industrial policy and intellectual property protection).[53] As a result, member states are bound by WTO rules to deregulate certain economic sectors

[51] The Uruguay Round of Multilateral Trade Negotiations held under the auspices of the General Agreement on Tariffs and Trade (GATT) concluded on April 14, 1994 in Marrakech, Morocco, where the Agreement Establishing the World Trade Organization (WTO Agreement) was signed. TRIPS is contained in Annex 1C of the WTO Agreement. For a general discussion on the revolution of international trade regime, see Peter D. Sutherland, "Concluding the Uruguay Round—Creating the New Architecture of Trade for the Global Economy", (2001) 24 Fordham Int'l L.J. 15. For the nature and limits of the revolution of international intellectual property regime, see J.H. Reichman, "From Free Riders to Fair Followers: Global Competition under the TRIPS Agreement" (1997) 29 N.Y.U.J. Int'l L. & Pol. 11, at 13-16; 26-86 [Reichman, "From Free Riders to Fair Followers].

[52] Veijo Heiskanen, "The Regulatory Philosophy of International Trade Law" (2004) 38 Journal of World Trade 1.

[53] From a regime theory perspective, the conceptual underpinnings of the multilateral trading system have changed as a result of the transformation of the GATT into the WTO. Mary Footer notes in this respect: "There is a perceivable shift from a process of negative integration under the GATT, where the major concern of the contracting parties was the progressive reduction of tariffs and the complimentary goal of non-discriminatory international trade, to that of positive integration in the WTO where Members must also undertake to legislate and enforce measures aimed at positive prescription in fields such as technical standards, health and safety standards, intellectual property rights and trade-related investment measures (minimum standards for investment), often with the goal of harmonising those standards." See Mary E. Footer, *An Institutional and Normative Analysis of the World Trade Organization*, (Leiden: Nijhoff, 2006) at 89.

and adopt a certain type of patent system. In addition to states' rights and obligations, the TRIPS Agreement positively prescribes substantive intellectual property rights that private economic actors shall enjoy. Therefore, WTO has become directly involved in the regulation of private economic activities.[54]

As to the revolution of the international intellectual property regime, the TRIPS Agreement sets a relatively high set of substantive and procedural "minimum standards" of intellectual property protection and enforcement. For the first time, the essence of "multilateralism"—Most-Favoured-Nation (MFN) obligation—is introduced to the field of intellectual property protection. More importantly, any disputes arising out of the TRIPS Agreement fall under the mandatory and exclusive jurisdiction of the WTO dispute settlement mechanism, which is widely considered the most effective and the only binding dispute settlement mechanism between states.

The patent section of the TRIPS Agreement has significantly increased the scope, duration and strength of patent protection and its enforcement throughout the world. It extends the scope of patentable subject matter to "any inventions, whether products or processes, in all fields of technology."[55] This effectively prohibits a WTO Member from categorically denying patent protection to, for example, pharmaceutical or biotechnology products and processes. One leading authority states that: "a general principle of eligibility to be patented is established. Any exclusion from patentability would therefore be looked

[54] The TRIPS Agreement "for the first time in WTO law, explicitly addresses private rights of economic operators, whereas the GATT and other agreements only address traders' rights indirectly as they formally give rights only to States…" See Thomas Cottier, "The TRIPS Agreement", *supra* note 25 in chapter 5, at 1043.
[55] TRIPS Agreement, *supra* note 1 in chapter 1, Art. 27.1.

upon as an exception to that rule."[56] Further, TRIPS requires a term ending not before 20 years from filing. TRIPS also strengthens the exclusive patent rights and limits the scope of exceptions such as compulsory licences and experimental uses. Finally, the increased patent protection is made more effective through enforcement rules. Members are required to establish fair and equitable judicial and administrative enforcement procedures both internally and at the border, including preliminary measures, border measures for prohibiting the importation of infringing goods, and criminal penalties for willful infringement of copyright and trademark.

5.2.1 An Overview of the TRIPS Patent Regime

This section gives an overview of the TRIPS Agreement and highlights four distinctive features of TRIPS that have transformed the landscape of international protection of intellectual property rights.[57] First, unlike other WTO rules which merely prohibit Members from engaging in trade restrictive practices, TRIPS is the first multilateral trade agreement to prescribe a detailed set of substantive standards and positive laws for Members to implement within their national legal systems.

Second, it is comprehensive in coverage and high in protection standards. It is the most comprehensive instrument for the protection of intellectual property in terms of the

[56] See Gervais, *The TRIPS Agreement*, *supra* note 5 in chapter 1, at 337. Gervais further explains the implication of "a general principle of eligibility to be patented" on interpretation and future negotiation: "…it should be interpreted in a restrictive fashion and be the subject of future negotiations towards its elimination." See fn 492 at 337.

[57] These distinctive features were also the major substantive issues in the TRIPS negotiation as described by David Hartridge and Arvind Subramanian: "(1) substantive standards or norms of IPR protection; (2) procedures under national law for the enforcement of IPR protection; (3) dispute settlement procedures between parties to any eventual agreement on TRIPs; (4) the relationship between the GATT and other relevant international organization, including WIPO, concerning TRIPs and the relationship between an eventual agreement in the Uruguay Round and the existing intellectual property conventions." See David Hartridge & Arvind Subramanian, "Intellectual Property Rights: The Issues in GATT" (1989) 22 Vand. J. Transnat'l L. 893, at 902.

subject matter as well as the enforcement, dispute settlement, and institutional arrangements. Furthermore, TRIPS sets relatively high standards of protection, which are "the standards of protection on which the industrial countries could agree among themselves."[58]

Third, by being one of the core WTO agreements, any intellectual property dispute arising out of the application or implementation of TRIPS falls under the mandatory jurisdiction of the WTO's binding dispute settlement mechanism. This is seen as the most important implication of incorporating intellectual property issues under the auspices of the WTO.[59] The rule-based, legalized WTO dispute settlement system is "arguably the most important systemic outcome of the Uruguay Round" and has been heralded as "the jewel in the crown" of the multilateral trading system.[60] Compared with the dispute settlement procedures under the WIPO administered conventions such as Paris and Berne, the WTO dispute settlement system provides "security and predictability" to the market place for ideas and its various operators such as intellectual property rights holders.[61]

Fourth, TRIPS has detailed rules and standards to which administrative and regulatory authorities as well as judicial bodies must adhere to ensure effective enforcement of intellectual property rights.

The TRIPS Agreement consists of seven parts. Part I sets out general provisions and basic principles. Part II obligates WTO Members to implement a set of substantives standards in their national legal systems. Part III establishes procedures and remedies at the

[58] Reichman notes that TRIPS represents "the standards of protection on which the industrial countries could agree among themselves." J.H. Reichman, "Securing Compliance with the TRIPS Agreement after U.S. v India", (1998) 1 Journal of International Economic Law at 586.
[59] Rochelle Cooper Dreyfuss & Andreas F. Lowenfeld, *supra* note 7 in chapter 1.
[60] J.H.H. Weiler, "The Rule of Lawyers and the Ethos of Diplomats", *supra* note 7 in chapter 1.
[61] *Supra* note 8 in chapter 1.

national level for intellectual property rights holders to effectively enforce their rights. Part IV addresses the registration and maintenance of intellectual property rights. Part V is devoted to dispute settlement under the TRIPS Agreement. Part VI concerns transitional arrangements. Part VII concerns various institutional and other matters.

5.2.2 The Neoliberal Approach and Market Fundamentalism of the TRIPS Patent Regime

The fall of the Berlin wall in 1989 marked a new world order and an unprecedented era of economic openness. Francis Fukuyama welcomingly declares that the collapse of communism as a form of government marks the end of history and the final triumph of economic and political liberalism. Liberal capitalism based on free market and liberal democracy, Fukuyama argues, may constitute the "final form of human government".[62] It is against this background that the TRIPS negotiation is dominated by a liberal thinking about intellectual property law and policy. In fact, most developing countries substantially changed their negotiating positions concerning most of the contentious issues in the TRIPS Agreement between 1991 and 1992 due to bilateral pressure as well as "developments not directly related to the negotiations such as the collapse of the Berlin wall, developments in the former USSR and substantial liberalization undertaken by the developing countries unilaterally and autonomously."[63]

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[62] Francis Fukuyama, "The End of History?" (1989) 16 National Interest. In a later published book, Fukuyama develops this thesis and further considers cautiously whether the displacement of all other forms of political and social organization with economic and political liberalism "may presage a material blandness and homogeneity and lack of engagement with great ideas that ideological conflicts in the past have provoked." See Francis Fukuyama, *The End of History and The Last Man* (New York: Free Press, 1991).

[63] B. K. Zutshi, "Bring TRIPS into the Multilateral Trading System", in Jagdish Bhagwati & Mathias Hirsch, eds., *The Uruguay Round and Beyond: Essays in Honor of Arthur Dunkel*, (Ann Arbor: University of Michigan Press, 1998) at 45.

The defining concept of liberalism—individual liberty and market efficiency—has been extended to the field of intellectual property through the TRIPS prescription of intellectual property rights being "private property rights". In the name of free trade and market efficiency, TRIPS globalized a liberal conceptual framework and ideology of individual rights and private property as the basis for both economic production and social organization.[64] The underlying logic of the TRIPS patent regime is that only through recognizing patent as individual rights and private property can we secure individual liberty and promote market efficiency. In this sense, TRIPS is both a commercial tool to harness market profits from competitive advantages in intellectual production and an ideological declaration that individual rights and private property are indispensable for such intellectual production. This is evident in the words of then United States Trade Representative Carla Hills, who openly argued that the strongest IPRs protection is the best policy for all societies.[65]

I see three problems associated with the TRIPS patent regime being dictated by economic and political liberalism. First, global proprietarianism threatens to turn all kinds of abstract information previously in the public domain into private ownership.[66] In essence, proprietarianism is the mantra that the first individual to have a connection with anything of economic value necessarily receives property rights to it. Peter Drahos describes the global

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[64] Kurt Burch, "Intellectual Property Rights and the Culture of Global Liberalism", (1995) 17:2 Science Communication 214 at 215. Kurt Burch contends that the expansion of ownership rights "promotes the vocabulary of rights and property and the liberal conceptual framework they help to define." See Kurt Burch, *"Property" and the Making of the International System*, (Boulder, Colo.: Lynne Rienner, 1998) at 215.

[65] Carla Hills called for "complete protection of intellectual property … [T]he higher the protection, the more…[intellectual property] benefits developing countries … [T]he more you protect intellectual property, [the more that] established firms are willing to pour more into research and development to try to address mankind's problems…" Quoted in James Boyle, *Shamans, Software, and Spleens: Law and the Construction of the Information Society*, (Cambridge, MA: Harvard University Press, 1997) at 124.

[66] Peter Drahos, *A Philosophy of Intellectual Property*, (Dartmouth: Ashgate, 1996), at 220.

ideological system of "proprietarianism" as having three fundamental values: "a belief in the moral priority of property rights over other rights and interests, a belief in the first connection thesis and the existence of a negative commons."[67] As a result, "the possessor should take all, […] ownership privileges should trump community interests and […] the world and its contents are open to ownership."[68] Second, the overwhelming focus on individual rights at the expense of communal and social interests may very well be contrary to the nature of human beings as social creatures and to social progress in general. Third, corporations in a competitive market economy are mandated to maximize profits and are not tasked with advancing the moral ethics and social responsibilities of capitalist production and innovative entrepreneurship. Thus, it is debatable whether the promotion of innovation and market efficiency is best advanced by the extension of free market exchange without a concept of socially responsible entrepreneurship.

The patent system originated from the Western cultural tradition, the capitalist economic system, and democratic institutions and, as a result, represents a distinctive Western liberal political tradition. As Carla Hesse puts it, "[t]he concept of intellectual property – the idea that an idea can be owned – is a child of the European Enlightenment."[69] The globalization of the patent system inevitably caused ideological conflicts between peoples and nations.

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[67] *Ibid*., at 202.
[68] *Ibid*.
[69] Carla Hesse explains: "It was only when people began to believe that knowledge came from the human mind working upon the senses–rather than through divine revelation, assisted by the study of ancient texts–that it became possible to imagine humans as creators, and hence owners, of new ideas rather than as mere transmitters of eternal verities." See Carla Hesse, "The Rise of Intellectual Property, 700 B.C.-A.D. 2000: An Idea in the Balance", (2002) 131:2 Daedalus 26 at 26.

The TRIPS Agreement represents the ultimate triumph of economic and political liberalism and echoes themes of the "market fundamentalism" which has dominated and endangered the global capitalist system. The TRIPS Agreement is a natural and logical completion of an ideological evolution in the global economic and political environment and represents the ultimate triumph of economic and political liberalism. The dominant economic paradigm of neoliberalism "proposes that human well-being can be best advanced by liberating individual entrepreneurial freedom and skills with an institutional framework characterized by strong private property rights, free markets and free trade. The role of the state is to create and preserve an institutional framework appropriate to such practices. […] But beyond these tasks the state should not venture. State intervention in market (once created) must be kept to a bare minimum…."[70]

Liberalism is a political theory that originated from Europe in the seventeenth century and is inextricably linked with democratic institutions and capitalist economies.[71] Liberal theorists such as Thomas Hobbes and John Locke argued that the freedom to pursue private interests, without interference – especially trade – is the basis for peace and prosperity.[72] A quick recapitulation of the economic foundation of the WTO trading system reveals that liberal trade theory and its contemporary reformulations have been the dominant theoretical basis. During the eighteenth and nineteenth centuries, classical economists such as Adam Smith, David Ricardo, and John Stuart Mill laid the foundation for the liberal theory of market-based economics, *laissez-faire* capitalism, and international trade. According to Adam Smith, countries gain from free trade if they have an absolute advantage

[70] See Harvey 2005, at 2.
[71] Paddy Ireland, "Neo-liberalism", in Peter Cane & Joanne Conaghan, eds., *The New Oxford Companion to Law*, (Oxford: Oxford University Press, 2008).
[72] *Ibid*.

in the production of a commodity.[73] David Ricardo, however, contended that potential gains from free trade are from comparative rather than absolute advantage.[74] Therefore, countries should specialize in the industries in which they are a relatively more efficient producer.

The classical liberal trade theory has been refined since the late nineteenth century. The first important reformulation was introduced by neoclassical trade theory. Paul Samuelson, a prominent economist of the twentieth century, contends that a country's comparative advantage is determined by the relative abundance and most advantageous combination of its factors of production. Samuelson states that: "Free trade promotes a mutually profitable division of labour, greatly enhances the potential real national product of all nations, and makes possible higher standards of living all over the globe."[75] The second reformulation of liberal trade theory is that free trade has the characteristic of a positive-sum game, which means a liberal international trading system is mutually beneficial because it creates more goods and maximizes the total world welfare for everyone.[76]

Modern liberalism has occupied the ideological mainstream since the establishment of the postwar "Bretton Woods" economic institutions.[77] The gradual, but increasing economic globalization that has occurred in the post-war years has liberalized international trade and investment and made free market capitalism the ultimate ideology for economic growth and higher standard of living. In the 1970s and 1980s, the Thatcher and Reagan governments, in

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[73] *Supra* note 26 in chapter 2.
[74] David Ricardo, *Principles of Political Economy and Taxation*, 1817.
[75] Paul Samuelson, *Economics*, 11th ed., (New York: McGraw Hill, 1980), at 651.
[76] Robert Gilpin, *The Political Economy of International Relations*, (Princeton, N.J.: Princeton University Press, 1987).
[77] Towards the end of the World War II, the victorious Allies at the Bretton Woods conference established postwar economic architecture, including the International Monetary Fund (IMF); the World Bank; and the International Trade Organization (ITO). For a history of the Bretton Woods system, see Orin Kirshner, ed., *The Bretton Woods-GATT System: Retrospect and Prospect after Fifty Years*, (Armonk, NY: M. E. Sharpe, 1996).

the UK and US respectively, promoted liberal economic policies and political institutions. The "Washington Consensus" imposed the "standard" economic reforms on developing countries focusing on privatization, liberalization and macro stability.[78] Thomas Friedman describes the "standard" economic reforms as the acceptance and application of neoliberalism – the "Golden Straightjacket":

> To fit in the Golden Straightjacket a country must either adopt, or be seen as moving toward, the following golden rules: making the private sector the primary engine of its economic growth, maintaining a low rate of inflation and price stability, shrinking the size of its state bureaucracy, maintaining as close to a balanced budget as possible, if not a surplus, eliminating and lowering tariffs on imported goods, removing restrictions on foreign investment, getting rid of quotas and domestic monopolies, increasing exports, privatizing state-owned industries and utilities, deregulating capital markets, making its currency convertible, opening its industries, stock and bond markets to direct foreign ownership and investment, deregulating its economy to promote as much domestic competition as possible, opening its banking and telecommunications systems to private ownership and competition and allowing its citizens to choose from an array of competing pension options and foreign-run pension and mutual funds.[79]

5.2.3 Evolving Views on the Impact of TRIPS on Innovation and Development

The patent system has evolved from an exception to monopoly under contentious legislation of a handful of European countries in the eighteenth century to an increasingly harmonized global system with universal minimum protection standards. The historical evolution of both the patent system and the TRIPS patent regime demonstrates that the ultimate purpose of the TRIPS patent protection is to promote innovation and development. Daniel Gervais provides a refined division of the history of the TRIPS Agreement into three

[78] John Williamson, "A Short History of the Washington Consensus", in Narcís Serra & Joseph E. Stiglitz, eds., *The Washington Consensus Reconsidered: Towards a New Global Governance*, (Oxford, UK: Oxford University Press, 2008) at 16-17.
[79] See Thomas L. Friedman, *The Lexus and the Olive Tree*, (New York: Anchor Books, 2000), at 105.

phases—the addition narratives; the subtraction narratives; and the calibration narratives.[80] I will adopt this model because it provides a good basis for understanding our evolving views on the impact of the TRIPS Agreement on innovation and development.

The first phase—the addition narratives phase—began with the initial linkage of intellectual property and trade during the Uruguay Round of Trade Negotiations and features a maximalist view of intellectual property being "a necessary ingredient of development" and thus, the more IP the better. Advocates of strong intellectual property rights argue that high levels of patent protection, especially in patent-sensitive sectors such as pharmaceuticals, may provide an incentive for firms to invest in research and development and transfer technology to developing countries. For example, Kitch has argued that firms in the developed countries will be more likely to invest and transfer technology to developing countries which provide strong IPRs protection.[81] Similarly, Keith Maskus claims that TRIPS promotes technological development and economic development of developing countries with strong IPRs through technology transfer and foreign direct investment.[82]

The second phase—the subtraction narratives phase—showed its first sign in the anti-globalization protests in Seattle and Quebec City and climaxed in the access to medicine and anti-biopiracy campaigns. TRIPS was criticized as a pure rent extraction vehicle from the developing countries, who took the "GATS and TRIPS for agriculture and textile" deal under coercion and/or without a vague comprehension of the devastating welfare costs and

[80] Daniel Gervais, "TRIPS 3.0: Policy Calibration and Innovation Displacement", in Chantal Thomas & Joel P. Trachtman, eds., *Developing Countries in the WTO Legal System*, (Oxford: Oxford University Press, 2009), at 363-365.
[81] Edmund W. Kitch, "The Patent Policy of Developing Countries" (1995) 13 UCLA Pac. Basin L.J. 166.
[82] Keith E. Maskus, *Intellectual Property Rights in the Global Economy*, *supra* note 22 in chapter 1, at 164; Keith E. Maskus, "Intellectual Property Rights and Economic Development", (2000) 32 Case W. Res. J. Int'l L. 471; Keith E. Maskus, "The Role of Intellectual Property Rights in Encouraging Foreign Direct Investment and Technology Transfer", (1999) 9 Duke J. Comp. & Int'l L. 109.

profoundly transformative implication of TRIPS.[83] In addition to the questionable legitimacy of TRIPS negotiating history, the more nuanced empirical evidence newly discovered in the West suggests a multiple and differentiated reality of the causal relationships between the level of intellectual property protection; foreign direct investment; and innovation and development. The conventional IP maximalist's proposition that a high level of intellectual property protection attracts more foreign direct investment, which necessarily promotes innovation and development in the recipient country is proven unfounded. Skeptics argue that TRIPS implementation in countries without complementing industrial policies and anti-competitive practices control may result in substantial welfare losses and little beneficial innovation.[84] For example, the lead World Bank economist for trade policy J. Michael Finger notes that a high level of intellectual property protection has traditionally been implemented only after an advanced level of development has been reached.[85] In fact, high levels of patent protection have served principally to transfer income from poor countries to rich countries and caused some countries serious development backlashes. The situation is particularly severe in the least-developed countries where the scientific infrastructure and intellectual base have not yet reached the point where they can positively react to the

[83] Sylvia Ostry comments that the Southern countries took the WTO deal (including TRIPS) "without a full comprehension of the profoundly transformative implication of the new system (an incomprehension shared by the Northern negotiators as well)." See Sylvia Ostry, "When You Come to a Fork in the Road, Take it Reflections on North American Integration: Regional and Multilateral" (2005) 1 Journal of International Law & International Relations 239, at 240.

[84] *Supra* note 9 in chapter 1.

[85] "Generally, most countries have been at an advanced stage of development before they provided the mandated level of protection for producers of intellectual property. France, for example, introduced pharmaceutical patent laws in 1960, Germany in 1968, Japan in 1976, Switzerland in 1977, and Italy and Sweden in 1978." See J. Michael Finger, "The WTO's Special Burden on Less Developed Countries", (2000) 19 Cato Journal 425 at 430, online: <http://www.cato.org/pubs/journal/cj19n3/cj19n3-9.pdf> citing C. Juma, "Intellectual Property and Globalization: Implications for Developing Countries", Science, Technology, and Innovation Working Paper No. 4, (Cambridge, MA: Center for International Development, 1999), at 18.

incentives of patent protection. Therefore, the social welfare costs of strong patent rights are likely to outweigh any potential benefits.[86]

The subtraction narratives call for reducing the negative impacts of TRIPS on welfare costs and encouraging local innovation potentials by using TRIPS exceptions and flexibilities. As a result, attempts to strengthen TRIPS enforcement provisions in the Doha Round and negotiate new treaties in the WIPO were countered by voices for development, as evidenced by the Doha Development Agenda and the WIPO Development Agenda. In the meanwhile, outside these two traditional intellectual property law and policy making fora, new IP norms and alternative policies were pushed forward in fora which were traditionally more sympathetic to development concerns. The Convention on Biological Diversity (CBD) and the Intergovernmental Working Group on Public Health, Innovation and Intellectual Property composed by the WTO and the WHO are two such examples.

Having learned from both extremes, the third phase—the calibration narrative phase—recognizes the differences and complexities in subject matter under diverse intellectual property categories; incentives needed for diverse industries; economic and technological levels of development; local conditions for productive technology transfer to occur; and innovation parameters. More importantly, the calibration narratives consider

[86] Carlos A. Primo Braga and Carsten Fink state: "If a country is small (i.e., its IPR regime does not affect world research and development) and it has limited production and innovation capabilities, higher standards of protection are likely to be welfare improving as long as they permit access to products that would not be available otherwise. If, however, the country has some production capabilities … but limited innovative capacity … higher standards of protection are likely to have a negative welfare impact, as local producers are displaced, prices rise and a rent transfer from local consumers and producers to foreign titleholders ensues. Finally, if the small country has both well developed production and innovative capabilities … the result will be indeterminate, depending on the elasticity of supply of domestic innovations with respect to IPRs protection ….[I]f one assumes that the supply of innovations in the South … is rather inelastic and that IPRs regimes are of limited relevance in influencing trade, foreign direct investment and technology transfer[,] then it follows that the Agreement is in essence an exercise in rent transfer. A much more optimistic view of its welfare implications for developing countries, however, can be put together if the opposite assumptions are held." *Supra* note 10 in chapter 1.

whether TRIPS, given the "staunchly utilitarian" approach to intellectual property as a "trade-related" right, is able to accommodate the above differences and complexities. Finally, the calibration narratives pay due attention to the competing and conflicting claims under non-trade regimes such as human rights.

These three stages show that normatively, intellectual property ought to function as a catalyst of innovation for the ultimate goal of promoting development. Spurring innovation for development concerns both global economic governance and domestic social regulation; and juxtaposes and connects diverse areas of public policies such as public health and education, information and industrial policy, and trade and competition. While TRIPS prescribes the overall level and model of patent protection, national patent regimes should be specifically designed to best advance their respective public policy objectives.

Therefore, I propose to incorporate TRIPS into a fair and balanced global innovation system to overcome these deficits. In particular, I will elaborate on five sets of freedoms that TRIPS flexibilities should allow governments to have in order to ensure world citizens have the freedom to innovate.

5.3 TRIPS Impacts on Innovation Capability and Freedom

There are five main problems that have caused the underperformance of the TRIPS patent regime in enhancing innovation capability in both developing and developed countries. First, the one-size-fits-all approach does not account for the differences of development levels and characters of technological fields and consequently causes inequality of innovation opportunity in different countries and technological fields. Second, it relies on patent incentives to promote innovation and ignores the dynamic roles of governmental

measures and alternative innovation models in incentivizing innovation. Third, the widening scope of patentable subject matter and strengthening of the patent rights restrict the public access to a vibrant innovation commons and hence stifle future innovation. Fourth, it limits Members' abilities to design a patent system that is suitable for its entrepreneurial culture and thus does not honor the dignity of entrepreneurial spirit. Fifth, the seller-oriented mass market TRIPS regime of innovation promotion is not compatible with indigenous innovation which is inherited from past generations and gradually improved through collective ingenuity and informal, communal, grassroot innovative practices.

5.3.1 Inequality of Innovation Opportunity between Countries and Technologies

The inequality of innovation opportunity has its root in the "bargain" between developing and developed countries in the Uruguay Round. As the TRIPS negotiation history shows, developed countries promised to open their markets for agriculture and textile and in turn, developing countries agreed to take on obligations in services and intellectual property rights. However, intellectual property concessions have different costs and effects on a country's domestic regulatory regime and market conditions. Market access for textile from developing countries is likely to enhance consumer welfare and produce economic gains for the importing developed countries. However, market access for intellectual property-reliant industries requires the establishment of intellectual property institutions and implementation of a complex set of intellectual property laws (in some cases from non-existence to full TRIPS compliance in a short transition period). In addition, it is not empirically proven that heightened intellectual property protection will benefit consumers and produce positive economic and social effects in all countries. On the contrary, there have

been studies showing that TRIPS implementation represents net welfare losses for developing countries and constraints on indigenous innovation.[87]

I argue that the formal equality of patent protection under the TRIPS Agreement has very different impacts in countries of different innovation capability and in technological fields with different lifecycles. As a result, innovators in different countries or different technological fields are afforded inequal innovation opportunities. As Sanjaya Lall has shown, "countries at different levels of industrial and technological development face very different economic costs and benefits from strong IPRs."[88] However, the uniform minimum TRIPS patent protection has extended these assumptions to a global scale and deliberately ignored the differences. Further, the technology neutral approach of patent protection is creating imbalances between different patentable subject matters, or different industries and sectors, some of which are more important to meet people's basic human rights, such as human rights to health. Therefore, substantive equality of innovation capability principle requires appropriate accommodation and differential treatment of developing countries in the implementation and enforcement of the TRIPS patent regime.

In order to facilitate global commercial exploitation of technological products,[89] it is important to have a certain level of commonality in substantive patent standards and harmony in the process for acquiring and enforcing patent rights. However, the one-size-fits-

[87] While patent protection is said to encourage indigenous innovation, if the scientific infrastructure and local capacity to conduct R&D is lacking, patent rights alone cannot encourage innovation. See Commission on Intellectual Property Rights, Integrating Intellectual Property Rights and Development Policy, (London, 2002), available online: <http://www.iprcommission.org/papers/pdfs/final_report/CIPRfullfinal.pdf> at 15. [CIPR, *Integrating Intellectual Property Rights and Development Policy*]

[88] Sanjaya Lall, "Indicators of the Relative Importance of IPRs in Developing Countries" (2003) 32 Research Policy 1657.

[89] For developed countries, TRIPS "permits their firms to exploit intellectual property rights in the markets of all of those countries that join the system." Edmund W. Kitch, "The Patent Policy of Developing Countries" (1995) 13 UCLA Pac. Basin L.J. 166 at 167.

all approach and the international harmonization of patent standards demanded by the TRIPS Agreement may have grave consequences on innovation systems, especially in developing countries, and may prove to widen development gaps between developed and developing countries.[90]

The one-size-fits-all patent protection does not differentiate between countries with different levels of innovation capability and development resources. The universal application of TRIPS minimum standards to all countries in all circumstances is inequitable and empirically unfounded.[91] For instance, TRIPS-mandated extension of the term of patent protection to a minimum of 20 years from filing "may or may not strike the right balance between competing social goals in every case. … The duration of a patent merely reflects a balance between competing social interests, aimed at maximizing social welfare."[92]

Since improved intellectual property protection has encouraged the creation and application of new technologies in developed countries, Robert Sherwood proposes that it will have the same innovation-increasing effects in developing countries.[93] However, this insight overlooks the institutional constraints and challenges that a low level of economic and technological development imposes. First, TRIPS implementation poses varying degrees of challenges and incurs different costs to developing countries and developed countries. The challenges of bringing domestic legislation into conformity with TRIPS and strengthening domestic institutions are different depending on a country's pre-existing level of compliance with TRIPS. For most developed countries, minor adjustments may be all that is needed.

[90] *Supra* note 50 in chapter 4, at 1-2.
[91] CIPR, *Integrating Intellectual Property Rights and Development Policy, supra* note 86 in chapter 5.
[92] *Supra* note 147 in chapter 4, at 262.
[93] Robert M. Sherwood, "Human Creativity for Economic Development: Patents Propel Technology" (2000) 33 Akron L. Rev. 351 at 358.

This is unsurprising since the intellectual property standards provided in TRIPS are modeled on the IP laws of the US and the EU.[94] For developing countries, which often do not share the Western tradition of protecting individuals' property rights in intellectual production,[95] TRIPS implementation requires building a whole set of intellectual property laws and institutions from the ground. Further, the informal implementation process of changing the traditional practices of property (i.e., collective ownership and communitarian use of resources) and increasing awareness, appreciation, and respect for intellectual property may be more difficult and time-consuming than formal implementation.[96] In other words, intellectual property protection goes well beyond being a legally enforceable private right and concerns the core of good governance.

Further, the costs of TRIPS implementation are particularly high for technology-importing developing countries because they are less able to implement TRIPS in a way to benefit their domestic industries and advance social welfare. For example, a study of TRIPS implementation in Indonesia shows that patent law reform has not benefited the country on balance because "it has not yet reached a stage of development where it has the potential to develop internationally important innovations with competitive value in the world market."[97] Moreover, the stringent patent protection dictated by TRIPS makes it more difficult for knowledge dissemination and technology transfer, and more expensive for the poor to have

[94] Gervais, *The TRIPS Agreement*, *supra* note 5 in chapter 1.
[95] *Supra* note 9 in chapter 1.
[96] For many of the developing and least-developed countries, "full protection of intellectual property rights, including through effective enforcement before national courts and administrative bodies will necessitate changes not only to laws but to well-rooted practices and involve additional expenses, welfare costs and changes in the role of the state with respect to innovation policy." See Daniel Gervais, *The TRIPS Agreement*, *supra* note 5 in chapter 1, at 156-157.
[97] Afifah Kusumadara, "Analysis of the Failure of the Implementation of Intellectual Property Laws in Indonesia" (2000) D.J.S Thesis, Faculty of Law, University of Sydney, available online: The Sydney eScholarship Repository, <http://ses.library.usyd.edu.au/bitstream/2123/820/2/adt-NU20021219.09193502whole.pdf>.

access to information and new technology. Walter G. Park and Juan Carlos Ginarte find that "countries not conducting innovative research or conducting a limited amount would enjoy few, if any, of the benefits of intellectual property protection because an innovation sector through which IPRs affect economic growth is absent."[98] In the meantime, the transfer of wealth through royalties and licensing fees from consumers in developing countries to foreign patent rights holders and the restrictions on the ability of developing countries to pursue their own development policies reduce social welfare.[99] According to a World Bank publication, if TRIPS were fully implemented, rent transfers to major technology-exporting countries, particularly the United States ($19.1 billion), Germany ($6.8 billion), and Japan ($5.7 billion), would amount to more than $40 billion.[100] As a result, the implementation of excessively stringent TRIPS patent standards has restricted the access and use of new technology and deterred innovation in many parts of the developing world. Second, TRIPS hampers developing countries' abilities to reverse engineer and carry out local imitative and adaptive innovation because it limits their freedom to deny patent protection on certain types of products, to exempt patent protection to advance public policy objectives, and to grant compulsory licences.[101]

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[98] Walter G. Park & Juan Carlos Ginarte, "Intellectual Property Rights and Economic Growth", (1997) 15:3 Contemporary Economic Policy 51 at 51.

[99] Bernard Hoekman, Aaditya Mattoo & Philip English, eds., *Development, Trade and the WTO: A Handbook*, (Washington, D.C.: World Bank, 2002), at 348.

[100] World Bank, *Global Economic Prospects and the Developing Countries 2002*, Chapter 5 Intellectual Property: Balancing Incentives with Competitive Access, (Washington, D.C.: World Bank, 2002), Table 5.1 at 133, online: <http://siteresources.worldbank.org/INTGEP/Resources/335315-1257200370513/05--Ch5--128-151.pdf>.

[101] Calestous Juma, "Intellectual Property Rights and Globalization: Implications for Developing Countries", Harvard University Center for International Development Working Paper Series, (1999), online: <http://www.cid.harvard.edu/archive/biotech/papers/discuss4.pdf>.

As Ha-Joon Chang points out, strong intellectual property protections have followed rather than caused economic and technological development.[102] Given the diverse political and organizational settings, Ha-Joon Chang suggests that development policies need to be contextualized, taking into account the country's specific historical, political, economic, ideological, and institutional setting. According to the World Bank, "countries have to develop an IPR strategy appropriate to their level of development, and then analyse carefully which, if any, IPR provisions ought to be contained in trade treaties or RTAs."[103] Calestous Juma and Lee Yee-Cheong propose a three-tiered system of IPR and enforcement to take into account different development levels.[104] Similarly, Peter Beattie states that "there does not seem to be much of a case for expanding strong IP protection uniformly across the developing world; rather, differentiated levels of IP protection should be applied with sensitivity toward levels of economic and technological sophistication".[105]

In addition, formal equality of TRIPS patent protection also requires a technology-neutral approach, which means that there would not be differences between different technological subject matters. The universally-applied TRIPS patent standards ignore the different nature and pattern of progress in different technological fields and the typical terms of innovation cycle in different industries. Burk and Lemley argue that "there is no reason to

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[102] *Supra* note 85 in chapter 4, at 293.
[103] World Bank, Global Economic Prospects: Trade Regionalism and Development 2005, (Washington, D.C.: World Bank, 2005) at 111.
[104] "Tier A countries would be required to comply with all provisions of TRIPS, including the legal framework and 'effective enforcement,' as required under Article 41. Developing countries with per capita GDP of, say, more than $5,000 would fall into this category (alternatively, an export criterion could be used). Tier B could apply to countries with per capita GDP of $1,000–$5,000. These countries would adopt the full legal framework required under TRIPS, perhaps with some minimal level of enforcement. Countries with per capita GDP of less than $1,000 (Tier C countries) would establish the legal framework required under TRIPS, perhaps with the exception of patent laws and protections for integrated circuits." See Calestous Juma & Lee Yee-Cheong, *Innovation: Applying Knowledge in Development,* UN Millennium Project Task Force on Science, Technology, and Innovation, (London: Earthscan, 2005) at 112-113.
[105] Peter Beattie, "The (Intellectual Property Law and) Economics of Innocent Fraud—The IP and Development Debate", (2007) 38:1 IIC 6 at 20-23.

assume that a unitary patent system will optimally encourage innovation in the wide range of diverse industries that it is expected to cover."[106] This is because different technology markets have different characteristics and respond differently to patent incentives: "[i]n some markets, particularly information technologies, innovations become obsolete so quickly that the patent system is little more than a costly nuisance. In other markets, such as pharmaceuticals, the commercial life of products can be very long and copying is easy, making patents particularly valuable."[107] In other words, innovation may be stimulated in certain industries, but stifled in others by the same TRIPS-compliant patent standard. Therefore, the technology-neutral approach of TRIPS patent protection is detrimental because it allows patents in fields related to food and health, such as agriculture and pharmaceutical, where the rights that patent holders can enforce might have a more significant impact on basic human rights.

Moreover, the technology neutrality approach of the TRIPS patent regime does not account for the dynamic nature of innovation and technological progress. The innovation market revolves around the incentives for and the rate at which markets produce innovation. The efficiency of innovation does not necessarily move in the same direction as the efficiency of the market in allocating property interests and facilitating proprietary production.[108] Indeed, an optimal level of innovation efficiency is determined by a series of dynamic equilibria between proprietary and non-proprietary production. These equilibria are missing in TRIPS where only a static prorpeitory model for innovation is present.

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[106] Dan L. Burk & Mark A. Lemley, "Policy Levers in Patent Law", (2003) 89 Va. L. Rev. 1575 at 1577.
[107] Bohannan & Hovenkamp, *Creation with Restraint, supra note* 14 in chapter 4, at xiii.
[108] "Therefore, although a proprietary system may result in a better approximation between consumer needs and innovation investment, a system that over-incentivizes investment in innovation may be counterproductive in terms of overall economic efficiency." See William van Caenegem, *Intellectual Property Law and Innovation*, (Cambridge, UK: Cambridge University Press, 2007) at 5.

In conclusion, formal equality of TRIPS patent protection has brought inequal innovation opportunities to innovators in developing and developed countries as well as innovators in different technological fields. Thus, appropriate accommodation and differential treatment of developing countries are required to ensure substantive equality of innovation capability for all innovators.

5.3.2 Inefficiency of Directing Innovation Resources to Patent Excessively

The main reason why TRIPS does not efficiently make use of innovation resources is that it does not address the incentives to innovate or modes of innovation other than granting patent privileges. Patents are only one of the many incentives to innovate; there are other incentive mechanisms such as the public incentivizing measures (prizes, subsidies, and tax credits) and user and open innovation models.[109] The TRIPS approach to incentivizing innovation through a private property rights-based system is inefficient in transforming innovation resources into productive outcomes. This is partially due to problems with the patent system, and partially due to TRIPS' restrictive effects on user and open innovation models that emerged after TRIPS was concluded.

[109] For a detailed review of incentives to innovate, see Suzanne Scotchmer, *Innovation and Incentives*, (Cambridge, MA: MIT Press, 2004); William M. Landes & Richard A. Posner, *The Economic Structure of Intellectual Property Law*, (Cambridge, MA: Belknap Press of Harvard University Press, 2003) at 294-296. But see Michele Boldrin & David K. Levine, *Against Intellectual monopoly*, (New York: Cambridge University Press, 2008) at 7 (arguing that the current intellectual property regime "does not increase either innovation or creation"). See also, Andrew W. Torrance & Bill Tomlinson, "Patents and the Regress of the Useful Arts," (2009) 10 Colum. Sci. & Tech. L. Rev. 130 at 131 ("T]here is no statistical difference in innovation, productivity, or societal utility between a pure patent system and a system combining patent and open source protection."). For a provocative study examining the relative importance of patents, copyrights, secrecy, and first-mover advantage in starup firms' ability to capture returns from innovations in biotechnology, medical devices, and software, see Stuart J.H. Graham, Robert P. Merges, Pam Samuelson & Ted Sichelman, "High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey," (2008) 24 Berkeley Tech. L.J. 1255.

A properly functioning patent system can stimulate innovation, disseminate knowledge, and facilitate the commercialization of innovation. However, the patent system is not always an effective mechanism to incentivize innovation as not all technological fields respond to patent incentives. The OECD report maintains that: "An initial economic investigation of the working of the patent system reveals limitations in the adequacy of this system for enhancing innovation and diffusion of technology."[110] In addition, there are some inherent problems and systematic inefficiencies in the patent system that have deterred competition and follow-on innovation. I will focus particularly on the issues of proliferation of trivial or non-deserving patents, lack of clear boundaries of right holders' exclusive rights, and fragmentation of rights.[111]

First, the issue of proliferation of trivial or non-deserving patents is caused by the winner-gets-all character of the patent system and the low patentability criteria. Patent race has led to increase in patent filings, considerable delay in processing patents and backlogs of applications even in some well-equipped patent offices.[112] Many issued patents are of low commercial use or make little contribution to the prior art.[113] Some patents are of questionable merit and should never have been granted. The OECD report finds: "More than

[110] *Ibid*., at 28.
[111] *Supra* note 100 in chapter 2 at 163.
[112] "Since the mid-1990s, the delay in processing patents has increased by more than 50 percent, and the backlog of applications has more than doubled." N.T. Gallini, "The Economics of Patents: Lessons from recent US Patent Reform," (2002) 16 Journal of Economic Perspectives 131 at 147.
[113] Adelman notes that more than 95% of patents have "little economic value." See D. E. Adelman, "Patent Metrics: The Mismeasure of Innovation in the Biotech Patent Debate," (2006) Arizona Legal Studies, Discussion Paper No. 06-10.

three-quarters of ICT firms in the survey reported that they now patent technologies they would not have patented a decade ago—even if the technology had been patentable then."[114]

Further, some companies acquire patents not to commercialize new technology but to decrease the chances of being sued, or to scare off competitors by threatening legal actions. Alfred Kahn notes: "From a business standpoint they are patent factories: they manufacture the raw material of monopoly."[115] As stated in the 2002 Report of the UK IPR Commission, the excessively lowered patentability criteria and improperly granted patents "may lead to behaviour by companies or public institutions that appears perverse from a social point of view. Organisations may patent in order to prevent others gaining access to areas of research or to ensure that other organisations cannot block their research."[116] Moreover, patent race has reduced efficiency in using innovation resources.[117] The duplication of research efforts has eliminated valuable innovation resources in other research areas.[118] The over-investment in R&D and wasteful investment in dead-end research (due to secrecy and information asymmetry) are another manifestation of inefficient use of innovation resources.[119] In short, the proliferation of trivial or non-deserving patents reduces efficiency of the patent system in using innovation resources.

Second, the boundaries that signal the exclusive rights of the patent holders are not clear. This is partially due to unresolved issue of what the appropriate patentable subject matter and threshold of patentability criteria (particularly, non-obviousness) should be. In

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[114] Organisation for Economic Co-operation and Development. Patents and Innovation: Trends and Policy Challenges, (Paris: OECD, 2004) at 25, online: <http://www.oecd.org/dataoecd/48/12/24508541.pdf>.
[115] Alfred Kahn in his article Fundamental Deficiencies of the American Patent Law, published in 1940, at 485.
[116] CIPR, *Integrating Intellectual Property Rights and Development Policy, supra* note 86 in chapter 5, at 126.
[117] S. M. Maurer & S. Scotchmer, "The Independent Invention Devence in Intellectual Property," (2002) 69 Economica 535.
[118] See John Duffy, "Rethinking the Prospect Theory of Patents," (2004) 71 U. Chi. L. Rev. 439.
[119] *Supra* note 107 in chapter 5 at 5.

addition, due to the inadequate application of the disclosure requirement, it is almost impossible to know for sure what exactly is invented and protected from the patent specification. As a result, more rights holders resort to courts to clarify the boundary of the exclusive rights and more scarce resources are diverted to infringement disputes and litigation costs.[120] The adverse effects on innovation provoked by unclear patent boundaries have been addressed by a report released in 2003 by the US Federal Trade Commission, which insightfully analyzes the interplay of patents, anticompetitive practices, and consumers' rights. According to the report: "Firms in the biotech industry reported that they avoid infringing questionable patents and therefore will refrain from entering or continuing with a particular field of research that such patents appear to cover."[121]

Third, fragmentation of rights can make it prohibitively expensive or practically infeasible to negotiate the right to make or sell anything.[122] Low transaction costs for the transfer and licensing of patent rights are essential for a healthy innovation market because the original inventor may not have the interest, resources, or expertise to bring his invention to a marketable format. However, the costs of innovation commercialization are high because of the fragmentation of rights and monopolization of specific technological areas. Fragmentation of rights refers to many rights holders control a segment of one single technology. It is not unusual that a single product consists of a large number of patents,

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[120] Keith E. Maskus & Jerome H. Reichman, "The Globalization of Private Knowledge Goods and the Privatization of Global Public Goods," in Keith E. Maskus & Jerome H. Reichman, eds., *International Public Goods and Transfer of Technology under a Globalized Intellectual Property Regime*, (Cambridge, UK: Cambridge University Press, 2005) at 33-35.

[121] Federal Trade Commission. *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*, (Washington, D.C.: U.S. FTC, 2003), at 5, online: <http://www.ftc.gov/os/2003/10/innovationrptsummary.pdf>.

[122] Carl Shapiro, *et al.*, "Navigating the Patent Thicket: Cross Licences, Patent Pools and Standard Setting" in Adam B. Jafffe, Josh Lerner, & Scott Stern, ed., *Innovation Policy and the Economy*, (Cambridge, MA: The MIT Press, 2001) at 119-150. See also, Jeremy de Beer, Richard Gold, & Mauricio Guaranga, "Intellectual Property Management: Policy Issues and Options," (Ottawa, ON: Genome Canada, 2011).

which results in patent trickets and royalty stacking. Patent thickets can restrict both follow-on innovation and upstream basic research because "each patent holder [has] a potential veto right over the innovations of others."[123] Due to risk of patent infringement, it is difficult to design around a patented technology and thus innovative activities are stifled.[124] Royalty stacking is the consequence of many patent licences on a single product. It can retard new innovation due to decreased profit margin and increased risk of litigation.[125]

In addition to the inherent inefficiencies of the patent system, TRIPS ignores the dynamic roles of governmental measures and alternative innovation models in incentivizing innovation. TRIPS does not address the user and open and collaborative innovation models which emerged after TRIPS was concluded. Neither does it harness the power of governmental measures in steering the flow of innovation resources. In this respect, Graeme Dinwoodie and Rochelle Dreyfuss argue: "The TRIPS Agreement's strong commitment to a particular vision of proprietary rights—and, on the patent side, to technological neutrality—makes it difficult to revise the law to deal with such matters as the thickets of rights created in the software and biotechnological sectors, open source innovation, and the new opportunities for serial and collaborative production."[126]

The TRIPS vision of exclusive, privilege-based, proprietary promotion of innovation restricts one's capability and freedom to innovate, suppresses the earnest human nature and

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[123] Richard A. Epstein & Bruce Kuhlik, "Navigating the Anticommons for Pharmaceutical Partners: Steady the Course on Hatch-Waxman," (2004) Univ. of Chi. Law Sch. John M. Olin Program in Law & Econ. Working Paper No. 209, available online: <http://ssrn.com/abstract=536322>. See also, Richard A. Epstein & Bruce Kuhlik, "Is There a Biomedical Anticommons," (2004) 27 Regulation 54-58.
[124] Joshua Gay, ed., *Free Software, Free Society: Selected Essays of Richard M. Stallman*, available online: <http://www.gnu.org/philosophy/fsfs/rms-essays.pdf>.
[125] *Ibid*.
[126] Graeme B. Dinwoodie & Rochelle C. Dreyfuss, "Designing A Global Intellectual Property System Responsive to Change: The WTO, WIPO, and Beyond", (2009) 46 Hous. L. Rev. 1187 at 1189.

basic human right to grow intellectually, and accordingly under-exploits the most valuable resource—intellectual resource or human ingenuity. This TRIPS vision restricts the adaptive and self-generative capability of the mass to innovate and is not conducive to intellectual collaboration and information exchange, is not tolerant to diverse knowledge systems, and does not promote open access and transparency in global innovation promotion and knowledge management. In short, as Katherine Strandburg points out, TRIPS, as a trade liberalization instrument, is inherently inadequate to promote new innovation models because it reflects a "sales-oriented, mass market" view of innovation which facilitates manufacturers gaining comparative advantage by producing mass market goods in one location and selling them in another.[127]

To summarize, the TRIPS approach to incentivizing innovation through a patent rights-based system is inefficient in using innovation resources because of (1) patent's inefficiencies such as proliferation of trivial patents, unclear boundaries of patent rights, and fragmentation of patent rights; and (2) under-exploitation of governmental measures and alternative innovation models in incentivizing innovation.

5.3.3 Diminishing Public Domain and Shrinking Innovation Commons

An open and vibrant innovation commons and protection for significant incremental innovations are two prerequisites for innovation.[128] The TRIPS patent regime may have a negative impact on the public domain of knowledge and innovation commons, and this holds true for both developing and developed countries. It is often believed that since developed

[127] *Supra* note 29 in chapter 1, at 889-890.
[128] "Protection of the public domain is essential. Those societies that have enjoyed the greatest amount of the innovation progress have provided substantial freedom for innovators to build on the work of their predecessors." See Bohannan & Hovenkamp, *Creation with Restraint, supra* note 14 in chapter 4, at x.

countries have strong domestic research and development capacity and management and marketing skills, their innovation capability is likely to increase as a result of stronger patent protection. However, this belief may be subject to some qualifications. If users and future innovators have to negotiate licences with a large number of patent rights holders due to broad patent claims and licensing practices, innovation could be stifled.[129] Furthermore, if the patent holder refuses to licence technology to other inventors, incremental innovation could be blocked due to the legal restrictions on using the existing technology.[130] In addition, upstream patents over fundamental science and products of nature may slow down innovation by denying users and future innovators access to a vibrant innovation commons and a dynamic public knowledge domain.

The TRIPS patent regime may negatively impact the innovation commons in a number of ways. First, by expanding the protectable subject matter and scope of patent protection and creating *sui generis* rights in previously unprotectable areas, the TRIPS patent regime has allowed the grant of overly broad patents, as for example in the area of biotechnology. The scope of patent claims delineates the boundary of the exclusive patent rights. A broad claim confers a large scope of patent rights and excessive monopoly control. In a technological field with broad claim patents, incremental innovations could be negatively impacted and even non-patented innovations cannot be implemented due to broad patent restrictions.[131] In particular, broad claims over research tools, basic science, and products of nature have anti-competitive effects on follow-on innovation and encroach upon

[129] *Supra* note 147 in chapter 4, at 267.
[130] *Supra* note 117 in chapter 5.
[131] Tim Wu, "Intellectual Property, Innovation and Decentralized Decisions," (2006) 92:1 Virginia L. Rev. 123. Wu argued that Thomas Edison's broad patent on the incandescent light slowed the progress of innovation in the incandescent lighting industry. *Ibid*., at 144.

foundational knowledge and information in the innovation commons.[132] Although some commentators point out that broad patent grants have static benefits,[133] patents with broad claims deter additional research and experimentation and future innovation due to concerns over patent litigation. The US Federal Trade Commission Report states that: "More patents in more industries and with greater breadth are not always the best ways to maximize consumer welfare."[134] In addition, the decreasing importance of patent-based incentives for innovation has "magnified the effects of scope and duration extensions."[135] According to Michael Carrier, "The increase in the importance of non-patent-based incentives for innovation has ensured that, in most industries—with the exception of a few, such as pharmaceuticals—patents are less crucial for innovation than they historically have been. Many firms today obtain patents to have leverage in negotiations with competitors, to prevent infringement lawsuits, or for use as a 'signaling device' to consumers, competitors, or investors. Such uses increase the dangers inherent in the expanding scope and effective duration of patents."[136] To summarize, the expanding scope of protectable subject matter and the creation of *sui generis* rights in plants and semiconductor chip designs, for example, have encroached upon a vibrant public domain that sustains innovation in the long term.

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[132] "The phenomenon of broad patents is most prevalent in the area of biotechnological research. One example is the US patent application by Human Genome Sciences over the whole genetic sequence of bacteria that causes meningitis. If granted, this patent could give its holder the power to restrict, in the US, the development of vaccines and other preventive medicines for meningitis, and possibly other diseases." See Simon Walker, "The TRIPS Agreement, Sustainable Development and the Public Interest", (IUCN, Gland, Switzerland, 2001) at 16, online: <http://data.iucn.org/dbtw-wpd/edocs/EPLP-041.pdf>.

[133] According to Edmund Kitch, broad patent grants may create "prospects" that can eliminate wasteful duplicative research and promote orderly development of a new invention. See Edmund W. Kitch, "The Nature and Function of the Patent System," (1977) 20 J.L. & Econ. 265 at 265-266. Kitch's theory was disputed by Robert Merges and Richard Nelson based on case studies of industries under broad patents. See Robert P. Merges & Richard R. Nelson, "On the Complex Economics of Patent Scope," (1990) 90 Colum. L. Rev. 839 at 871-878, 884-915.

[134] Federal Trade Commission. *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*, (Washington, D.C.: U.S. FTC, 2003), at 18, online: <http://www.ftc.gov/os/2003/10/innovationrptsummary.pdf>.

[135] *Supra* note 9 in chapter 4, at 17-19.

[136] *Supra* note 9 in chapter 4, at 17-19.

Second, the cross-licensing practices of some companies and patent thickets increase transaction costs and cause what Michael Heller and Rebecca Eisenberg term a "tragedy of the anti-commons" problem.[137] The anti-commons is a resource where any number of people have the right to veto someone else's ability to use that resource. A tragedy of the anti-commons refers to a problem where many independent rights result in "gridlock" and may potentially block information flow, slow or hinder research, hamper competition, and stifle innovation.[138] The broad consensus to solve this problem is to facilitate collaborative partnership and exploit networked knowledge.[139]Mark Myers is concerned that "there is a growing imbalance of information that is freely available for inventive use compared to information whose use is restricted. The 'public domain', 'the scientific commons', and the 'Mertonian ethos' are being threatened by the decline of the public role of the great corporate central research laboratories and by the push at universities to patent their research. What used to be public research is now becoming proprietary."[140] By the "Mertonian ethos" Myers refers to the norm of sharing and communalism in basic research.[141] The scientific culture of open communication and exchange is undermined as researchers are reluctant to

[137] Heller & Eisenberg, "Can Patents Deter Innovation?" *supra* note 36 in chapter 1; Heller, "The Tragedy of the Anticommons", *supra* note 36 in chapter 1.
[138] Heller, *The Gridlock Economy, supra* note 36 in chapter 1.
[139] OECD Working Party on Biotechnology, "Collaborative Mechanisms for Intellectual Property Management in the Life Sciences." (Paris: Organization for Economic Co-operation and Development, 2010). See also, Peter Phillips, "The Challenge of Creating, Protecting and Exploiting Networked Knowledge," in E. Einsiedel & F. Timmermans, eds., *Crossing Over: Genomics in the Public Arena*, (Calgary: University of Calgary Press, 2005) at 7-32.
[140] Mark B. Myers, "In Support of Invention—Intellectual Property" in Invention: Enhancing Inventiveness for Quality of Life, Competitiveness, and Sustainability, Report of the Committee for Study of Invention, sponsored by the Lemelson-MIT Program and the National Science Foundation, (April 23, 2004), online: <http://web.mit.edu/invent/n-pressreleases/downloads/report_web.pdf>. [Myers, "In Support of Invention"]
[141] See Katherine J. Strandburg, "Curiosity-Driven Research and University Technology Transfer," in Gary D. Libecap, ed., *University Entrepreneurship and Technology Transfer: Process, Design, and Intellectual Property*, (Amsterdam: Elsevier JAI, 2005) Advances in the study of Entrepreneurship, Innovation and Economic Growth, vol. 16, 2005; Fiona Murray, et al. "Of Mice and Academics: Examining the Effect of Openness on Innovation," (National Bureau of Economic Research Working Paper, No. 14819, 2009), available online: <http://www.nber.org/papers/w14819>. Rochelle Cooper Dreyfuss, "Does IP Need IP? Accommodating Intellectual Production Outside the Intellectual Property Paradigm," (2010) 31 Cardozo L. Rev. 1437.

disclose new discovery and research findings in public presentations, grant proposals and published papers, fearing to destroy novelty.

To summarize, there have been extensive discussions about the expanding boundary of intellectual property rights and the diminishing public domain of knowledge as a result.[142] By setting international standards of minimum intellectual property protection, TRIPS accelerates the ever-expanding scope of intellectual property protection domestically, both in terms of subject matter and the economic interests at stake.

5.3.4 Failing Entrepreneurial Spirit

TRIPS limits Members' abilities to design an optimal innovation system that serves the specific needs of different types of entrepreneurs as well as suits its entrepreneurial culture. In particular, TRIPS favours the interests of corporate entrepreneurs over individual entrepreneurs.

5.3.5 Incompatability with Indigenous Innovation

TRIPS undermines indigenous innovation capability in both developing and developed countries because it gives little account to the specific cultural traditions and knowledge systems of indigenous communities. Indigenous innovation is often inherited from past generations and gradually improved through collective ingenuity and informal, communal, grassroot innovative practices. However, TRIPS does not provide for collective rights as its Preamble states that "intellectual property rights are private rights." This appears incompatible with the communal approach common to many indigenous people.

[142] See *supra* note 47 in chapter 4.

The insensitivity to developing countries' innovation capability and administrative and financial burdens associated with the TRIPS patent regime casts serious doubt on its effectiveness to promote informal innovation ("grassroot" or "base of the pyramid" innovation), which is particularly relevant to developing countries. The TRIPS patent standards are modeled on the more sophisticated Western patent system and are more effective at protecting the proprietary interests of Western commercial enterprises. The type of innovation that is most relevant to developing countries is often undertaken by individuals, who have limited technological and financial resources to acquire and maintain patents.[143] World Bank notes that innovation-spurred growth "tends to be fairly insignificant until countries move into the middle-income bracket."[144] TRIPS is likely to hinder the access of grassroots innovators in developing countries to the patent system.[145]

TRIPS criteria for obtaining a patent are at odds with the characters of indigenous innovation. First, indigenous innovation does not meet the novelty criterion for patentability. A patent should not be granted to something that is known, being part of the prior art, and does not exhibit novelty. Indigenous innovation has been developed over generations and thus is not the new creation of an individual or group. Second, patent rights are limited in time. Indigenous innovation is ancestral and held in trust for future generations. A time frame of 20 years protection is inconsistent with these obligations. When the patent expires, the knowledge is open for all to exploit, even if this transgresses traditional values and degrades sacred spirits. Third, for a patent to be granted, it must be fully and sufficiently described and that description published. This is in conflict with the indigenous way of

[143] *Supra* note 139 in chapter 5.
[144] *Supra* note 99 in chapter 5 at 129.
[145] Anil Gupta, Securing Traditional Knowledge and Contemporary Innovations: Can Global Trade Links Help Grassroots Innovations? Honey Bee Perspective.

storing knowledge orally, with a few trusted people, protected by traditional customs and norms. Publication undermines the integrity of traditional knowledge.

Further, TRIPS is incompatible with the principles and values of indigenous people. TRIPS is in conflict with traditional values (such as traditional guardianship, confidentiality, and the communal nature of "rights" to natural resources) and communal ownership. At the international level, states that are signatories to TRIPS are restricted in how far they can change their patent system unilaterally to meet the concerns of indigenous peoples. Sovereignty over genetic resources is another major issue. Native flora and fauna, and traditional knowledge of their properties and uses, can be used as a resource for furthering Western scientific knowledge, or for commercial exploitation. This in turn gives rise to issues of ownership, veto, access, and benefit-sharing with indigenous peoples who have developed the knowledge, and have guardianship responsibilities for the plants and animals. There are tensions between the CBD and TRIPS. The CBD states that access to genetic resources should be subject to "prior informed consent," meaning that authorization of the donor or community holding the resource or material should be sought and obtained in order to access the resource and/or the knowledge. TRIPS, however, does not have any provision recognizing the principle of benefit-sharing or acknowledging the need to obtain prior consent or consultation in accessing genetic resources.

The incompatibility of the TRIPS Agreement with indigenous innovation has negative impacts on indigenous communities in terms of technology transfer and foreign direct investment. In the first instance, the implementation of the TRIPS Agreement has not led to technology transfer to developing countries. TRIPS proponents have argued that strong patent protection is a fundamental prerequisite for technology transfer and that the

disclosure of technology obtained from patents allows developing countries to obtain and exploit the technology for their benefit. This view is echoed by Beier, who states, "It is only patent protection which gives enterprises the necessary incentive to file their important inventions abroad and converts an invention to an object of international trade that can be transferred without too great a risk."[146] Greif is of the same view that patent-protected imports contribute directly to the transfer of foreign technology, which is subsequently followed by developing indigenous technology through establishing local production facilities.[147] However, other research suggests that patents are one of several factors that are considered in technology transfer transactions.[148] In technology transfer decisions, enterprises have considerations in addition to the existence of a patent system, such as economic, political, and legal considerations, including taxation laws and foreign investment laws in general.[149] Furthermore, patents will not play a significant role in the economic development of developing countries until certain basic "technological dynamism" is achieved.[150] For instance, Hansen identifies three stages of technology transfer to developing countries. At the initial stage, he posits that there is total reliance on foreign technology, as there is little indigenous R&D capacity. In the second stage, with the establishment of

[146] F.K. Beier, "The Significance of the Patent System for Technical, Economic and Social Progress", (1980) 11 International Review of Industrial Property and Copyright Law 563 at 584.
[147] S. Greif, "The Role of Patent Protected Imports in the Transfer of Technology to Developing Countries", (1979) 10 International Review of Industrial Property and Copyright Law 123 at 124; and F.K. Beier, "The Significance of the Patent System for Technical, Economic and Social Progress", (1980) 11 International Review of Industrial Property and Copyright Law 563 at 584.
[148] Hans Peter Kunz-Hallstein, "Patent protection, Transfer of Technology and Developing Countries: A Survey of the present situation", (1975) 6 International Review of Industrial Property and Copyright Law 427 at 432-433.
[149] C. Twinomukunzi, "The International Patent System: A Third World Perspective", (1982) 22 Indian Journal of International Law 31 at 59. Another example of the indirect linkage between the patent system and technology transfer is that technology is often transferred through technical knowhow spillovers by individual experts. See S. Wyatt, "Patents and Multi National Corporations: Results from Questionnaire", (1985) 7 World Patent Information 200.
[150] UNCTAD, "Transfer and Development of Technology in a Changing Environment: The Challenge of the 1990's", Doc. TD/B/C.6/153, 25 Jan 1991, 15

industrial plants, a skilled workforce begins to develop when foreign technology is adapted and applied by nationals. And finally, in the third stage, significant capacity for initiative research occurs when adequate intellectual property protection becomes significant to facilitate the foreign direct investment.[151]

In truth, there is no hard evidence to show correlation between the levels of intellectual property protection and technology transfer.[152] The Commission on Intellectual Property Rights concluded that countries that have acquired significant technological capabilities have had weak IP protection and that in general weak IP protection is more likely to lead to economic growth as developing countries are dependent on reverse engineering.[153] Historically, Japan, the US, South Korea and Taiwan relied on reverse engineering possible only through weak patents in the early stages of industrialization.[154]

As to my second point regarding negative impact on indigenous communities, the overall assessment of a high level of patent protection in developing countries suggests that it has limited effect in terms of attracting foreign direct investment. The 2005 World Bank Global Economic Prospects states that: "Evidence is inconclusive about the responsiveness of FDI to intellectual property regimes."[155] Similarly, the OECD study points out that concrete empirical evidence proving the need to strengthen IPRs is lacking. The study states that "[m]ost of the changes to patent regimes implemented over the past two decades were

[151] B. Hansen, "Economic Aspects of Technology Transfer to Developing Countries", (1980) 11 International Review of Industrial Property and Copyright Law 429 at 432-439.
[152] Carlos M. Correa, "Can the TRIPS Agreement Foster Technology Transfer to Developing Countries?" in Keith E. Maskus & Jerome H. Reichman, eds., *International Public Goods and Transfer of Technology under a Globalized Intellectual property Regime*, (Cambridge: Cambridge University Press, 2005) at 28.
[153] CIPR, *Integrating Intellectual Property Rights and Development Policy, supra* note 86 in chapter 5, at 22.
[154] Sanjaya Lal, "Indicators of the Relative Importance of IPRs in Developing Countries," (2003) at 1.
[155] World Bank, 2005 Global Economic Prospects, at 110, online: <http://siteresources.worldbank.org/INTGEP2005/Resources/GEP107053_Ch05.pdf>.

not based on hard evidence or economic analysis."[156] In addition, some of the largest recipients of foreign investment happen to be the worst violators of intellectual property laws.[157] Strong intellectual property protection alone is insufficient to attract foreign direct investment.[158] There is more to consider than intellectual property rights when a foreign corporation is looking to invest in a particular country. According to Jeong-Yeon Lee & Edwin Mansfield, a mere increase in patent protection will not by itself bring about extra FDI into a country.[159] Other factors such as tax incentives, quality of infrastructure, political stability, skills availability, and input prices influence foreign direct investment decisions more than the strength of patent protection.[160] Research strongly supports the view that where corporations are looking to invest, the decision is made by referring to a whole host of macro-economic factors, which includes, but is not limited to, the strength of the patent protection. Claudio Frischtak concurs with this view and states that the overall investment climate and legal system holistically are more important than the strength of the patent protection regime.[161]

To reiterate, TRIPS is incompatible with indigenous innovation and has negative impacts on indigenous communities in terms of technology transfer and foreign direct investment.

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[156] Organisation for Economic Co-operation and Development, Patents and Innovation: Trends and Policy Challenges, (Paris: OECD, 2004) at 26, online: <http://www.oecd.org/dataoecd/48/12/24508541.pdf>.
[157] Duncan Matthews, *Globalizing Intellectual Property Rights: The TRIPS Agreement*, (London: Routledge, 2002), at 112.
[158] CIPR, *Integrating Intellectual Property Rights and Development Policy, supra* note 86, at 13.
[159] Jeong-Yeon Lee & Edwin Mansfield, "Intellectual Property Protection and U.S. Foreign Direct Investment", (1996) 78:2 Review of Economics and Statistics 181 at 185.
[160] See Carlos A. Braga & Carsten Fink, "Reforming Intellectual Property Rights Regimes: Challenges for Developing Countries," (1998) 1 Journal of International Economic Law 537 at 554; Keith E. Maskus, "Benefiting from Intellectual Property Protection," in Bernard Hoekman, Aaditya Matto & Philip English, eds., *Development Trade and the WTO: A Handbook*, (Washington, D.C.: World Bank, 2002), at 369.
[161] See Claudio R. Frischtak, "Harmonization versus Differentiation, in Intellectual Property Right Regimes", in Mitchel B. Wallerstein, Mary E. Mogee & Robin A. Schoen, eds., *Global Dimensions of Intellectual Property Rights in Science and Technology*, (Washington, D.C.: National Academy Press, 1993) 89 at 103-105.

5.4 Towards a Fair and Balanced Global Innovation System

This section argues that there is a comprehensive international framework for the protection and enforcement of patent rights, as embodied in such international instruments as TRIPS; however, action to formulate an international innovation policy and construct a global innovation system has not yet begun.

The international framework for innovation promotion contains the key instruments and institutions undergirding the international framework for cultivating innovation capability and extracting value from new and useful processes, products, and services. International instruments of innovation promotion can be generally broken into three categories according to their legal effects, methods used in their formulation, and functions. At the foundation of the international innovation framework is a sophisticated web of bilateral and multilateral agreements negotiated between and among states through diplomatic conferences or international organizations. This hard law type of instrument is legally binding and concerns basic substantive and procedural rights and obligations pertaining to intellectual property protection. It offers the greatest reliability of implementation, compliance and effectiveness in terms of dispute resolution and enforcement. One prominent example in this category is the TRIPS Agreement. Other examples are the Paris Convention for the Protection of Industrial Property (1883), the Berne Convention for the Protection of Literary and Artistic Works (1886), the Madrid Agreement for the Repression of False or Deceptive Indications of Sources on Goods (1891), the Madrid Agreement Concerning the International Recognition of Marks (1891), the Hague Agreement Converning the International Deposit of Industrial Designs (1925), the Universal

Copyright Convention (1952), and the Lisbon Agreement for the Protection of Appellations of Origin and their International Registration (1958).

In addition to these multilateral agreements, the increasingly complex international intellectual property regime also includes a growing array of bilateral and regional trade agreements imposing TRIPS-plus standards on developing countries by the EU and the US. This thesis focuses primarily on the TRIPS patent regime in terms of its impacts on the global innovation environment and potential costs and benefits of its implementation at the national level. It only touches upon unilateral initiatives and intellectual property chapters in bilateral and regional trade agreements when needed.

The second category of instruments aims to harmonize international classification standards and streamline administrative procedures pertaining to acquiring and maintaining intellectual property rights. An example of the former is the Strasbourg Agreement Concerning the International Patent Classification (1971); and the Patent Cooperation Treaty (1970) is an example of the latter. The Patent Cooperation Treaty is aimed to facilitate patent filing processes in multiple jurisdictions and realize a high level of harmonization of patent systems in general.

The third category of international instruments involves soft law types of recommendations or guidelines encouraging countries to adopt measures voluntarily and policy coordination types of instruments initiated by countries on their own on the basis of mutual consultations.[162]

[162] See Junji Nakagawa, *International Harmonization of Economic Regulation*, translated by Jonathan Bloch & Tara Cannon, (Oxford: Oxford University Press, 2011) at 3.

This section analyzes the need for a global innovation system and the importance of supportive institutional framework for future innovation and pro-poor innovation. I argue that the existing instruments and institutions undergirding the international framework for promoting innovation should be adjusted to accommodate the emerging innovation models in the shifting global innovation paradigm. In particular, the TRIPS patent regime should be integrated into a fair and balanced global innovation system by re-interpretation and re-implementation.

5.5 Conclusion

This Chapter has examined the globalization of innovation paradigm and the five main problems that have caused the underperformance of the TRIPS patent regime in enhancing innovation capability in both developing and developed countries. It calls for the need to integrate the TRIPS patent regime into a fair and balanced global innovation system to ensure substantive equality of innovation capability of the world population and their freedom to innovate.

Chapter Six: The Legal Implications and Policy Recommendations of Incorporating the TRIPS Patent Regime into a Global Innovation System

This chapter analyzes the legal implications of a global innovation system on the TRIPS patent regime and puts forward policy recommendations for TRIPS implementation, interpretation, and enforcement. It envisions a global framework for democratic innovation governance that enables global citizens to access political influence and participate in legislative debate and policy development that affect their basic innovation capability and freedom. It argues that the existing instruments and institutions undergirding the international framework for promoting innovation must be adjusted to account for human rights based norms such as equality and freedom, and to accommodate the emerging innovation models in the shifting global innovation paradigm. In particular, this chapter argues that there is a need to correct the imbalance in the TRIPS patent regime and integrate it into an optimal global innovation system through implementation and interpretation.

An optimal global innovation system is one that upholds five doctrinal legal principles of equality of innovation opportunity, neutrality of innovation models, accessibility of the innovation commons, dignity of the entrepreneurial spirit, and respect for indigenous innovation. First, a global innovation system should ensure equality of innovation opportunity and optimize the exploitation of intellectual resources. Second, a global innovation system should foster knowledge exchange and open and collaborative innovation while balancing proprietary and non-proprietary innovation incentives to a desirable ratio. Third, a global innovation system should cultivate a vibrant innovation commons that is accessible to the public. Fourth, a global innovation system should drive the

development of human ingenuity and protect the dignity of entrepreneurial spirit. And fifth, a global innovation system should reconcile the tension between the patent system and indigenous innovation.

By becoming an integral part of a principle-based global innovation system, the TRIPS patent regime can overcome its inefficiencies in optimizing innovative activities and promote the values that underpin an optimal global innovation system: equality and freedom. The globalization of economic production and the decentralization of innovation production have enabled an innovative mass and popularized nascent business models that are based on collaborative innovation capabilities. The international patent system can be made fairer towards the poor because people everywhere now have a better chance of transforming their ideas into real values. An economy powered by knowledge goods and information assets should logically be more equal to the poor because of the ever-accumulating enrichment and equalizing effects of innovation production. A global innovation system can be made more balanced if it integrates and blends open and closed innovation models to an optimal ratio.

Taking into consideration these principles and values, this chapter discusses certain changes that should be made to the implementation and interpretation of the TRIPS patent provisions. It suggests ways to translate abstract principles of substantive equality of innovation capability and the freedom to innovate into concrete legal obligations and interpretations as well as policy instruments that are important for both developing and developed countries to develop individuals to their fullest potential. I will focus on how an innovation capability and freedom approach changes the objectives, designs, rights, and duties of international patent law. The benefit of using an innovation capability and freedom approach to inform patent law and policy is to broaden the theoretical basis of TRIPS to go

beyond utilitarianism and mercantilism justifications of the patent and trade systems and embrace broader human rights based norms. In addition, it allows TRIPS interpreters and innovation policymakers to consider a dynamic view of distributive justice and intergenerational equality.

Specifically, this chapter makes recommendations to explore the flexibilities embedded in TRIPS patent provisions and to develop normative and institutional framework outside TRIPS to accommodate dynamic innovation modes. With respect to TRIPS flexibilities, I propose strategies to operationalize equality of innovation opportunity (in section 6.1), to balance the patent system and non-proprietary innovation systems (in section 6.2), and to cultivate an accessible innovation commons (in section 6.3). With respect to non-TRIPS-related recommendations, I suggest that the WIPO can and should play a more important role in promoting respect for entrepreneurial spirit and indigenous innovation (in section 6.4). Utilizing TRIPS flexibilities and engaging the WIPO in global innovation governance aim to strike a fairer balance between innovation and access. Working together, these recommendations can enhance the effectiveness of the TRIPS patent regime in promoting innovation and distributing the burdens and benefits of innovation equitably among nations and generations.

6.1 Implementing TRIPS Flexibilities to Operationalize Equality of Innovation Opportunity

TRIPS flexibilities can be utilized to operationalize the equality of innovation opportunity principle by providing accommodations for development levels and technological fields. TRIPS article 1.1 gives member states the freedom to implement TRIPS

general principles and legal obligations in accordance with their respective economic and technological levels and the sophistication of their legal systems, albeit with important limitations. I argue that the TRIPS implementation should take a flexible approach that is compatible with countries' development priorities and innovation strategies. Further, countries should also take into consideration their respective legal system, economic structure, cultural character, and innovation policy in the implementation and interpretation of TRIPS obligations. Moreover, implementing TRIPS-plus protection, as evidenced in many developing countries,[1] is not generally recommended, especially when the decision is coerced due to diplomatic and political pressure from donors, investors, and trading partners.

A global equality of innovation opportunity requires that equally capable and motivated persons who participate in the global innovation competition should have a roughly equal chance to benefit from their innovative effort and investment irrespective of the society to which they belong.[2] The premise underlying the global equality of innovation opportunity is that everyone, regardless of her innovation capability, how she allocates her innovation resources into different innovation domains, or how she chooses to be compensated, should have equal opportunity and access to learn, build upon others' ideas, and cultivate her own innovation capability.

[1] Based on analysis of TRIPS-based legislative reforms in 107 countries, Carolyn Deere found that a significant number of developing countries and 14 least-developed countries have implemented even higher IP standards than those required by TRIPS. See Carolyn Deere, *The Implementation Game: The TRIPS Agreement and the Global Politics of Intellectual Property Reform in Developing Countries*, (Oxford: Oxford University Press, 2009).

[2] Sylvia Loriaux, "Global Equality of Opportunity: A Proposal," (2008) 11 Journal of International Relations and Development, at 2 (proposing a "competitive" conception of global equality of opportunity, which demands that the global rich should ensure that: "(1) global economic rules duly represent the interests of all the parties concerned, and (2) all the persons who participate in the global economic order are given the capability to acquire the talents that predict success in the global marketplace.")

As it now stands, the TRIPS patent regime is inadequate to promote equal innovation opportunities between developing and developed countries. TRIPS takes a formal equality approach by requiring all countries to adhere to the principles of non-discrimination, substantive minimum standard of protection, technology neutrality, and uniform dispute settlement procedures.[3] I argue that the TRIPS formal equality treatment has different impacts on WTO members with different development levels and hence a principle of substantive equality should be endorsed in order for TRIPS to be incorporated into a fair and balanced global innovation system.

The substantive equality principle requires appropriate accommodation and differential treatment of developing countries in the implementation and enforcement of the TRIPS patent regime. The main justification for the accommodation requirement is that WTO members do not compete for innovation resources on equal terms due to their different capabilities to harness the ingenuity of their innovators. Neither do innovators around the world stand on a level playing field to exploit and harvest their intellect. Therefore, to ensure equal opportunity to innovate for countries with different innovation capabilities and a level playing field for all innovators, preferential conditions should be accorded to the WTO members with lesser innovation capabilities to stand on a level playing field to exploit and harvest their intellectual capital.

Another reason for the accommodation requirement is that WTO members at different levels of industrial and economic development have different innovation capability and face different economic costs and benefits from the minimum patent protection

[3] Margaret Chon, "Intellectual Property and the Development Divide," *supra* note 25 in chapter 1, at 2891 (stating: "the international intellectual property regime of TRIPS currently functions on a 'formal equality' rather than actual equality basis").

standards prescribed by TRIPS.[4] The fact that a certain level of patent protection helped the development of some industries and economies does not mean that the higher the protection the better. Nor does it mean that strong patent rights will help other industries or economies. The optimal patent law and policy for a developing country varies according to the level of economic and technological development.[5] It has been argued that:

> … only after countries have accumulated sufficient indigenous capabilities with extensive science and technology infrastructure to undertake creative imitation in the later stage that IPR protection becomes an important element in technology transfer and industrial activities …. [S]trong IPR protection will hinder rather than facilitate technology transfer and indigenous learning activities in the early stage of industrialization when learning takes place through reverse engineering and duplicative imitation of mature foreign products[6]

Patent policy makers in developing countries first need to identify technological areas and types of innovation which are of strategic significance and then design the scope and strength of patent rights and appropriate exceptions and limitations to remedy overprotection or underprotection.[7] In addition, there seems to be a threshold of per capita income level below which patents have nominal impacts on innovation activities. Maskus notes: "Econometric cross-section evidence suggests that there is an inverted-U shaped relationship between the strength of IPRs and income levels. The intensity of IPRs first falls with rising

[4] Sanjaya Lall, "Indicators of the Relative Importance of IPRs in Developing Countries" (2003) 32 Research Policy 1657.
[5] *Supra* note 90 in chapter 4, at 765.
[6] L. Kim, "Technology Transfer and Intellectual Property Rights: The Experience of Korea, Issues Paper no. 2, UNCTAD-ICTSD Project on Intellectual Property Rights and Sustainable Development, (2003) at 5.
[7] Sean Pager argues that a developing country should structure its patent regime according to its economic and technological development level as well as what sort of innovation it aims to promote. More specifically, Pager suggests that a developing country should consider the following technological benefits in structuring its patent system: "(1) providing incentives and support for indigenous innovation; (2) encouraging local entrepreneurship; (3) disseminating knowledge of foreign technologies to the public; (4) encouraging the transfer of proprietary technology by foreign companies; and (5) creating incentives to develop or adapt technologies to meet specific national needs. Ancillary benefits may include: (6) generating revenues from patent fees; (7) developing a reservoir of technical and scientific expertise; and (8) providing jobs to local graduates. Patent systems should also be designed with a view to minimizing costs, such as (9) conserving institutional resources devoted to administration; (10) preventing anticompetitive abuse of patent rights; (11) limiting the flow of rents to foreign patent-holders; and (12) preserving the public domain." See *supra* note 90 in chapter 4, at 763-764.

incomes, as countries move to slack IPRs to build local capabilities by copying, then rises as they engage in more innovative effort. The turning point is $7,750 per capita in 1985 prices…, a fairly high level of income for the developing world."[8] Similarly, Ha-Joon Chang argues that there may be an inverse-U-shaped relationship between the strength of intellectual property protection and economic development, where either below or above an optimal protection level is counter-productive.[9]

Furthermore, patents are not necessary to stimulate innovation and encourage disclosure at all times. In other words, patent incentives are one of the many reasons why people innovate. Lall provides the evidence that "the need for IPRs varies with the level of development."[10] As consumers' demands for innovative goods increase, firms' innovation capabilities grow accordingly and interests in stronger patent rights emerge endogenously. Maskus notes that historically "[m]any rich countries used weak IPR protection in their early stage of industrialisation to develop local technological bases, increasing protection as they approached the leaders."[11] He goes on to suggest that:

> countries at different levels of economic development would prefer to set standards of varying degrees of liberality. The least-developed countries might opt for TRIPS-consistent minimal standards with wide limitations. Middle-income industrializing economies should see the value of more protective standards and firm recognition of trade secrets. Countries where most technology developers reside would prefer strict standards combined with regulation of competition.[12]

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[8] Keith E. Maskus, *Intellectual Property Rights in the Global Economy*, *supra* note 22 in chapter 1, at 95-96.
[9] See Ha-Joon Chang, ed., *Institutional Change and Economic Development*, (New York, NY: United Nations University Press, 2007) at 24.
[10] Lall, S. with M. Albaladejo, "Indicators of the relative importance of IPRs in developing countries", (2003) Issues Paper No. 3, UNCTAD-ICTSD Project on Intellectual Property Rights and Sustainable Development, Geneva.
[11] Keith E. Maskus, *Intellectual Property Rights in the Global Economy*, *supra* note 22 in chapter 1, at 95-96.
[12] *Ibid*., at 177.

To summarize, patent protection should not be regarded as an end in itself. What is important for economic development is not to afford the highest level of patent protection, but to decide which patent rights to protect, to what extent under which conditions. Therefore, developing countries require special accommodation measures to match their levels of patent protection to the levels of innovation capabilities and sophistication of innovation activities.

In addition to the justifications laid out above, the requirement to accommodate development levels can find support in two fundamental TRIPS principles. The first principle is the freedom of implementation and the second is the special and differential treatment principle. I will address them in turn.

The freedom to accommodate the special needs of developing countries and characteristics of technological fields is justified and supported by TRIPS Article 1.1, which provides that "[m]embers shall be free to determine the appropriate method of implementing the provisions of this Agreement within their own legal system and practice." Clearly Article 1.1 gives the WTO members considerable discretion in choosing the appropriate method of implementing TRIPS obligations in national legal systems and hence allows them to tailor their intellectual property regimes to domestic technological, economic, and institutional conditions.[13] Article 1.1 also makes it clear that TRIPS is not intended to be a harmonization

[13] Rajan Dhanjee & Laurence Boisson de Chazournes, "Trade Related Aspects of Intellectual Property Rights (TRIPS): Objectives, Approaches and Basic Principles of the GATT and of Intellectual Property Conventions", (1990) 24:5 Journal of World Trade 5 at 11 (stating: "the IP conventions leave it to the Member States to find for themselves, at their national level, the appropriate balance between the rights and obligations of holders of IP rights vis-à-vis the public (including potential competitors)…").

agreement, provided that members exercise their freedom to legislate and implement at least the minimum threshold of intellectual property protection established by the Agreement.[14]

The freedom of implementation is exercised through (1) designing national patent law and policy to "give effect to" TRIPS obligations; and (2) deciding whether TRIPS has direct applicability in national legal systems. The first prong of the freedom of implementation is of particular significance in situations where TRIPS deliberately leaves open or simply enunciates, but does not define, certain critical terms such as "novelty" in TRIPS Art. 27.1 concerning patentability criteria, and "national emergency" in Art. 31(b) concerning compulsory licensing. The freedom of implementation has been upheld in India – Patents (US), where the Appellate Body (AB) stated that: "Members, therefore, are free to determine how best to meet their obligations under the TRIPS Agreement within the context of their own legal systems."[15]

The second prong of the freedom of implementation gives members the freedom to define the relationship between international treaty obligations and domestic laws in their constitution.[16] Article 1.1 obliges Members to "give effect" to the provisions of the

[14] Adrian Otten & Hannu Wager, "Compliance with TRIPS: The Emerging World View", (1996) 29 Vand. J. Transnat'l L. 391, at 394.

[15] Appellate Body Report, India—Patents (US), WT/DS50/AB/R, at para 59. [India—Patents] Commenting on the case, Jerome Reichman notes that: "the decision in US v India confirms that the developing countries are free to adopt their own laws and policies with respect to all the intellectual property issues that were not expressly harmonized in the TRIPS standards themselves. Because a vast body of unharmonized intellectual property law survived the TRIPS Agreement, the developing countries necessarily retain a high degree of discretion with which to reconcile the burdens that the TRIPS Agreement did impose with the needs of their own national systems of innovation." See Jerome H. Reichman, "Securing Compliance with the TRIPS Agreement after US v India", (1998) Journal of International Economic Law 585 at 597.

[16] UNCTAD explains: "There are generally three approaches. Under the "monist" approach the treaty is essentially treated as part of national law without any action needed by the national government other than to accept the treaty (e.g., in Argentina, France and the Netherlands). Under the "dualist" approach the treaty and national law are considered separate, except to the extent that the national government takes specific steps to transform all or part of the treaty into national law (e.g., in the United Kingdom). There is a middle ground approach in which treaties may be given direct effect, but the rights and obligations may also be modified by the legislature (e.g., in the United States)." UNCTAD-ICTSD, *Resource Book on TRIPS and Development*,

Agreement. In some cases, international treaties are self-executing and have "direct effect" and form part of national laws, while other national laws do not recognize the direct effect of international treaties. Generally speaking, if a country recognizes direct effect for the TRIPS Agreement, private parties may directly rely on its terms before national courts. Therefore, the interpretation of TRIPS and its embedded flexibility will be the task of judicial interpretation, and the legislative or executive authorities will lose the option of transforming TRIPS obligations into national law through the adoption of specific legislation and administrative regulations.

The TRIPS Agreement as a whole is generally considered not self-executing, although certain provisions may be directly applied in national courts.[17] In fact, recognizing the direct applicability of the entire Agreement may have negative legal and policy effects and reduce the predictability of TRIPS interpretation. First, how to interpret TRIPS in such a way that optimally implements its obligations is beyond the expertise of the judicial bodies alone. It is a task that demands collective input from all stakeholders and collaborative efforts to carefully weigh the pros and cons of legal strategies and policy objectives. Further,

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(Cambridge: Cambridge University Press, 2005), footnote 34 at 19, online: <http://www.iprsonline.org/unctadictsd/docs/RB_1.2_update.pdf>. [UNCTAD-ICTSD, *Resource Book on TRIPS and Development*]

[17] Daniel Gervais, *The TRIPS Agreement*, supra *note* 5 in chapter 1, at 164-165. See also, Carvalho, *The TRIPS Regime of Patent Rights*, at 59, stating that "the provisions of the TRIPS Agreement are not self-executing…" Some provisions of TRIPS such as Article 31 can be applied directly but others such as Article 32, which requires judicial review be available for patent revocation or forfeiture, are not operable without further specification in national laws and regulations. On the issue of direct effect of TRIPS in the EC, see Thomas Oppermann & Jose Christian Cascante, "Dispute Settlement in the EC: Lessons for the GATT/WTO Dispute Settlement System", in Ernst-Ulrich Petersmann, ed., *International Trade Law and the GATT/WTO Dispute Settlement System*, (Boston: Kluwer Law International, 1997), at 467-486. See also judgment of the Court of Justice of the European Communities with respect to "direct effect" and the interpretation of Article 50 of the TRIPS Agreement in the context of the European law, joined Cases C-300 and 392/98, December 14, 2000, *Parfums Christian Dior SA v Tuk Consultancy BV*, (C-300/98) and Assco Gerüste GmbH and Rob van Dijk v Wilhelm Layher GmbH & Co. KG and Layher BV, (C-392/98) [2001] E.T.M.R. 26; [2001] E.C.D.R. 12; and judgment of the Court of Justice of the European Communities, Case C-53/96, *Herms International v. F.H.T. Marketing Choice BV*, 16 June 1998, (1998) ECR I-3603.

judicial decisions on the same provision of TRIPS may vary greatly from one case to another, which is not conducive to producing a predictable and systematic interpretation of TRIPS. Therefore, in order to take full advantage of the freedom to implement TRIPS, it is advisable that developing countries treat the TRIPS Agreement as not self-executing.

6.1.1 Implementing Special and Differential Treatment to Accommodate Development Levels

I will now consider how the Special and Differential Treatment (SDT) principle could be better implemented to accommodate development levels. The SDT principle is premised on the idea that the assumption of international obligations should be commensurate with the level of economic development.[18] Put differently, "unequals should be treated unequally in order to obtain an equitable application of the principle of equality." [19] The SDT aims to "distribute the benefits from trade equitably between developed and developing countries."[20] Ricardo Melendez-Ortiz and Ali Dehlavi define the SDT as follows:

> [T]he term special and differential treatment [S&D] refers to the set of provisions in trade accords which have been negotiated to grant developing country exports preferential access to markets of developed countries, and operationalise the notion that developing countries taking part in trade negotiations have no obligation to reciprocate fully the concessions they receive. [S&D] also implies longer timeframes and lower levels of obligations for developing countries for adherence to the rules. It is a fundamental cross cutting

[18] Rajan Dhanjee & Laurence Boisson de Chazournes, "Trade Related Aspects of Intellectual Property Rights (TRIPS): Objectives, Approaches and Basic Principles of the GATT and of Intellectual Property Conventions," (1990) 24:5 Journal of World Trade 5 at 13.

[19] Edward Kwakwa, "Emerging International Development Law and Traditional International Law—Congruence or Cleavage?" (1987) 17 Ga. J. Int'l & Comp. L. 431 at 438. The SDT principle is "reminiscent of the Aristotelean definition of equality as requiring that the unequal should be treated unequally." See (1986) 1 Y. B. Int'l Law Comm'n 208.

[20] Nandang Sutrisno, "Substantive Justice Formulated, Implemented, and Enforced as Formal and Procedural Justice: A Lesson from WTO Special and Differential Treatment Provisions for Developing Countries," (2010) 13 J. Gender Race & Just. 671 at 672.

> issue for developing countries in the Multilateral Trading System (MTS) and is an integral part of the balance of rights and obligations in the Uruguay Round Agreements (URAs).[21]

Conferring differential and more favourable treatment on developing countries has been an important norm and principle in the multilateral trading system and recognized in international law as a long-standing legitimate doctrine to tackle the global challenge of distributive inequality.[22] The special and differential treatment of developing countries was first introduced to the then GATT system during the Tokyo round negotiation.[23] It has since been an integral part and important principle of WTO law and international economic relations in general.[24] The preamble of the WTO Agreement states that the objective of SDT for developing countries is "to ensure that developing countries, especially the least developed among them, secure a share in the growth of international trade commensurate with the needs of their economic development." Similarly, the preamble of the TRIPS Agreement recognizes that least-developed countries have special needs requiring maximum flexibility in their domestic implementation of laws and regulations in order to enable them to create a sound and viable technological base. More recently, the Doha Declaration recognizes that SDT provisions are "an integral part of the WTO Agreements" and agrees

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[21] Ricardo Melendez-Ortiz & Ali Dehlavi, "Sustainable Development and Environmental Policy Objectives: A Case for Updating Special and Differential Treatment in the WTO", presented at the CUTS/Center for International Trade, Economics & Environment Conference on Southern Agenda for the Next Millennium, Bangalore, India, August 18-19, 1999, cited in *supra* note 55 in chapter 6, at 675 fn 25.

[22] Phillippe Cullet, "Differential Treatment in International Law: Towards a New Paradigm of Inter-state Relations," (1999) 10:3 EJIL 549-582.

[23] GATT Secretariat, Differential and More Favourable Treatment, Reciprocity and Fuller Participation of Developing Countries: Decision of 28 November 1979, L/4903 (Dec. 4, 1979), online WTO <http://docsonline.wto.org/DDFDocuments/t/JCR/TOKYO/ENABLING.WPF>. See also, Edwini Kessie, "Enforceability of the Legal Provisions Relating to Special and Differential Treatment under the WTO Agreements", (2000) 3:6 Journal of World Intellectual Property 955, at 958-961.

[24] For instance, Article 19 of the Charter of Economic Rights and Duties of States explicitly states: "With a view to accelerating the economic growth of developing countries and bridging the economic gap between developed and developing countries, developed countries should grant generalized preferential non-reciprocal and non-discriminatory treatment to developing countries in those fields of international economic cooperation where it may be feasible." G.A. Res. 1281, 29 U.N. GAOR Supp. (No. 31), U.N. Doc. A/9631 (1975), reprinted in 14 I.L.M. 251, at art. 19 (1975).

that all SDT provisions should be reviewed with the aim to strengthen them and make them more "precise, effective and operational".[25]

The WTO Secretariat classifies SDT provisions into several categories, including:

> (i) provisions aimed at increasing the trade opportunities of developing country Members;
>
> (ii) provisions under which WTO Members should safeguard the interests of developing country Members;
>
> (iii) flexibility of commitments, of actions, and use of policy instruments;
>
> (iv) transitional time periods;
>
> (v) technical assistance;
>
> (vi) provisions relating to least-developed country Members.[26]

The TRIPS Agreement contains mainly three types of SDT provisions to accommodate developing countries' interests, namely transitional arrangements (Articles 65.2, 65.4, and 66.1), technology transfer (Article 66.2), and technical cooperation (Article 67).[27] I will briefly introduce these SDT provisions before offering some practical suggestions for a more effective mechanism for accommodating development levels.

Articles 65 and 66 of the TRIPS Agreement provide for different transitional periods for different groups of countries to bring their laws and practices into conformity with the TRIPS Agreement. Developing countries and economies in transition have a 5-year period, which means TRIPS entered into force on January 1, 2000. However, if a developing

[25] *Supra* note 3 in chapter 3, at para. 44.
[26] WTO Secretariat, Implementation of Special and Differential Treatment Provisions in WTO Agreements and Decisions, WT/COMTD/W/77, at para. 3, available online: <www.wto.org/english/tratop_e/devel_e/w77_e.doc>.
[27] In addition to these three types of Special and Differential Treatment (SDT) provisions, the recognition of developmental objectives in the Preamble and members' freedom to decide the method of implementation in art. 1.1 can be broadly categorized as development friendly provisions.

country did not provide product patent protection in an area of technology in its territory (such as pharmaceuticals) when the TRIPS Agreement came into force on January 1, 1995, it had until January 1, 2005 to introduce the protection, subject to the "mail-box" protection provisions of Article 70(8) and the "exclusive marketing rights" provisions of Article 70(9).[28] Under Article 66.1, the least-developed-countries had originally until January 1, 2006 to implement TRIPS. This deadline has been extended (1) until July 1, 2013 by the TRIPS Council decision in 2005 with regard to general TRIPS obligations other than Articles 3, 4 and 5;[29] and (2) until January 1 2016 with regard to pharmaceutical products at the June 27 2002 TRIPS Council meeting based on the Doha Ministerial Declaration on Public Health (WT/MIN(01)/DEC/2, para. 7).[30] Belatedly, the General Council adopted a decision to waive the LDCs' obligations under TRIPS Art. 70.9 with regard to exclusive marketing rights for pharmaceutical patents on July 8, 2002 until January 1 2016.[31]

Another example of an SDT is the technology transfer provision. Building a sound and viable technological base through, *inter alia*, promoting innovation and technology transfer is one of the objectives of intellectual property protection explicitly laid out in TRIPS Art. 7. The LDCs' particular needs for maximum flexibility in implementing TRIPS and for

[28] The India—Patent Protection for Pharmaceutical and Agricultural Chemical Products Panel noted: "A critical part of the deal struck was that developing countries that did not provide product patent protection for pharmaceuticals and agricultural chemicals were permitted to delay the introduction thereof for a period of ten years from the entry into force of the WTO Agreement. However, if they chose to do so, they were required to put in place a means by which patent applications for such inventions could be filed so as to allow the preservation of their novelty and priority for the purposes of determining their eligibility for protection by a patent after the expiry of the transitional period." WT/DS50/R, para. 7.29.

[29] See WTO document, "Extension of the Transition Period under Article 66.1 of the TRIPS Agreement for Least-Developed Country Members: Decision of the Council for TRIPS of 29 November 2005", IP/C/40, November 30, 2005.

[30] See WTO document, "Extension of the Transition Period under Article 66.1 of the TRIPS Agreement for Least-Developed Country Members for Certain Obligations with Respect to Pharmaceutical Products: Decision of the Council for TRIPS of 27 June 2002", IP/C/25, July 1, 2002.

[31] See WTO document, "Least-Developed Country Members—Obligations under Article 70.9 of the TRIPS Agreement with respect to Pharmaceutical Products: Decision of 8 July 2002", WT/L/478, July 12, 2002.

technical and financial cooperation have long been recognized in the TRIPS preamble and WTO charter.[32] These constitutional provisions provide a legal basis for the interpretation and application of the LDCs-specific technology transfer provision in the TRIPS Agreement.[33] Article 66.2 requires developed country members to provide incentives to their enterprises and institutions to help promote technology transfer to LDCs. This mandatory obligation is an explicit recognition that LDCs may have particular difficulty satisfying their TRIPS obligation and may not benefit from the TRIPS standard of intellectual property protection. In fact, it is a generally accepted view that below a certain development threshold, countries (including mostly LDCs) would not benefit from high level of patent protection simply because the costs of providing such protection overweigh any potential benefits.[34]

[32] For instance, Art. XXII para. 1 of the Marrakesh Agreement Establishing the World Trade Organization states that LDCs "will only be required to undertake commitments and concessions to the extent consistent with their individual development, financial and trade needs, or their administrative and institutional capabilities." Para. 2(iii) of the same states that WTO rules "should be applied in a flexible and supportive manner for the least-developed countries. To this effect, sympathetic consideration shall be given to specific and motivated concerns raised by the least-developed countries in the appropriate Councils and Committees." See *Marrakesh Agreement Establishing the World Trade Organization*, signed in Marrakesh, Morocco, 15 April 1994, reprinted in (1994) 33 I.L.M. 81(entered into force 1 January 1995), incorporating "Ministerial Decision on Measures in Favour of Least-Developed Countries", adopted by the Trade Negotiations Committee on April 15 1994, LT/UR/D-1/3, at para 1, online: <http://www.wto.org/english/docs_e/legal_e/31-dlldc.pdf>.

[33] Art. 66.2 is "tantamount to special and differential treatment for least-developed country Members." WTO document, "Mechanism for Ensuring the Monitoring and Full Implementation of the Obligations under Article 66.2 of the TRIPS Agreement in Accordance with Paragraph 11.2 of the Doha Decision on Implementation-Related Issues and Concerns: Communication from Least-Developed Countries", IP/C/W/357, July 5, 2002, at para. 2.

[34] "… below certain developmental thresholds, the introduction of high levels of intellectual property protection will not generate positive impacts". See Daniel Gervais, "TRIPS 3.0: Policy Calibration and Innovation Displacement", in Chantal Thomas & Joel P. Trachtman, eds., *Developing Countries in the WTO Legal System*, (Oxford: Oxford University Press, 2009), at 367. The view that countries below certain development thresholds are unlikely to benefit from high level of patent protection is also supported by proponents of the TRIPS patent regime: "However, the least developed countries would not benefit from patent protection, simply because the cost of reforming or creating a new patent protection system outweighs the potential benefits they could achieve." See Ali M. Imam, "How Does Patent Protection Help Developing Countries" (2006) 37:3 International Review of Industrial Property and competition Law, 245-370. See also, WIPO, *Intellectual Property Profile of the Least Developed Countries*, (Geneva: WIPO, 2002).

The third type of SDT is technical cooperation, which commits developed countries to provide technical and financial cooperation in favour of the developing and least-developed countries in the implementation and enforcement of TRIPS as well as the prevention of intellectual property rights abuse.[35] Article 67 provides a non-exhaustive list of specific forms of cooperation to which the developing and least-developed countries can make a request:

> (1) assistance in preparation of laws and regulations on the protection and enforcement of intellectual property rights;
>
> (2) prevention of the abuse of intellectual property rights;
>
> (3) support regarding the establishment of reinforcement of domestic offices and agencies relevant to these matters; and
>
> (4) training of the personnel for domestic offices and agencies.[36]

I argue that the above three types of SDT provisions provide justification for accommodating development levels but are insufficient to foster substantive equality among states and accommodate their divergences in economic development levels and different capabilities to provide for a global public good—innovation. Generally speaking, the insufficiency in promoting substantive equality is partially due to the legal effect, scope of application, and practical effectiveness of the SDT provisions. With respect to the legal effect, the transitional periods are not long enough and the technology transfer and technical cooperation provisions are not legally binding but only of the best endeavour nature.[37] With respect to the scope of application, the technology transfer provision applies only to the least

[35] See generally, Kirsten M. Koepsel, "How do Developed Countries Meet Their Obligations under Article 67 TRIPS Agreement", (2004) 44 IDEA 167-208; B. Callan, "The Potential for Transatlantic Cooperation on Intellectual Property in Asia", Berkley Research on International Economics (BRIE) Working Paper 116, 1998.
[36] TRIPS Article 67.
[37] Amin Alavi, "Special and Differential Treatment Provisions in the TRIPs Negotiations", *supra* note 81 in chapter 3, at 55.

developed countries. With respect to the practical effectiveness of these SDT provisions in WTO Members, the technology transfer and technical cooperation provisions are often formalistic and procedurally onerous, and do not provide substantive benefits to developing countries.

For the above reasons, TRIPS SDT provisions are insufficient to accommodate developing countries' interests in terms of their implementation and enforcement. With respect to implementation, SDT provisions usually come with conditions that are onerous for developing countries to meet and non-operative in practice. With respect to enforcement, the WTO dispute settlement Panels and AB have interpreted SDT provisions strictly and narrowly that favours developed countries' interests to the disadvantage of developing countries.[38] In fact, most of the dispute settlement cases where developing countries invoke SDT provisions have been unsuccessful.[39]

From the above discussion, we can see that notwithstanding the importance of the SDT principle in bridging the gap between innovation capabilities of states, it is not without limits.[40] In order to overcome the limitations in accommodating developing countries' interests and to construct effective SDT mechanisms, I suggest that SDT provisions should be treated as one of the constitutional principles of the WTO (i.e., SDT should have the same status as MFN). The theoretical foundation of the SDT principle is of less significance than fundamental principles of law or other WTO principles. For example, Andrew Mitchell

[38] *Supra* note 55 in chapter 6, at 701.
[39] *Ibid*., at 695.
[40] See generally, Claire Melamed, "Doing 'Development' at the World Trade Organization: The Doha Round and Special and Differential Treatment", (2003) 34: 3 IDS Bulletin 12-23; Bernard Hoekman, Constantine Michalopoulos, & L. Alan Winter, "Special and Differential Treatment of Developing Countries in the WTO: Moving Forward After Cancun", (2004) 27:4 World Economy 481-506; Mari Pangestu, "Special and Differential Treatment in the Millennium: Special for Whom and How Different?", (2000) 23:9 World Economy 1285-1302.

notes that the SDT principle is not informed by any general principle of law or principle of customary international law.[41] By treating SDT as a fundamental principle of the WTO, the effectiveness and enforceability of the SDT provisions will be enhanced. Second, SDT provisions should be clear and precise. The vagueness of the SDT provisions in TRIPS renders them ineffective in WTO dispute settlements.[42] Third, the heterogenous needs of developing countries and the contested economic implications of the SDT undermine its usefulness as an interpretive tool.[43] Fourth, the focus of SDT provisions has shifted from market-access and developmental issues to transitional period and technical assistance to enhance developing countries' implementation and enforcement capacity.[44]

I propose three specific changes to the TRIPS SDT concessions: (1) extending the transition periods; (2) providing accommodation on substantive issues; and (3) instituting effective mechanisms to increase incentives for technology transfer and technical assistance.

First, I argue that the transition periods do not allow developing and least-developed countries adequate time to slowly adapt their intellectual property laws to TRIPS standards. Oseitutu posits: "Although TRIPS provided for a delayed implementation period for developing and least-developed countries, the grace periods of five and ten years that were

[41] Andrew D. Mitchell, *Legal Principles in WTO Disputes*, (Cambridge, UK: Cambridge University Press, 2008), at 272.
[42] Amin Alavi, "On the (Non-)Effectiveness of the World Trade Organization Special and Differential Treatments in the Dispute Settlement Process", *supra* note 81 in chapter 3.
[43] Andrew D. Mitchell, *Legal Principles in WTO Disputes*, (Cambridge, UK: Cambridge University Press, 2008), at 272.
[44] John Whalley, "Special and Differential Treatment in the Millennium Round", (1999) 22:8 World Economy 1065-1093.

given to the developing and least-developed countries were inadequate."[45] Similarly, it has been argued that:

> … the transitional periods are inadequate to cope with their lack of capabilities, or to accommodate their development needs properly. In relation to the TRIPS Agreement, for instance, creating new or adjusting existing legislation to conform with the standards of the TRIPS agreement generally requires a period much longer than the five years allowed and a huge amount of funds. This is also the case with the enforcement of the legislation.[46]

It is unrealistic to expect countries with no legal tradition to protect private property rights in intangibles to comply fully with sophisticated TRIPS provisions in merely one decade. It took industrial countries over 100 years to gradually increase their levels of patent protection so that they could acquire the tacit, embodied knowledge and institutional capacity to make technologies work for development.[47] Ha-Joon Chang argues: "[I]t seems unfair to ask modern-day developing countries to behave to a standard that was not even remotely observed when the now-advanced countries were at a similar, or even more advanced, stage of development." [48] Therefore, it is unrealistic and unjust to expect developing countries to achieve the same transition in the limited transitional period provided under TRIPS. A creditable argument could be made, at the very least, to extend to the LDCs a transitional period that would allow them to develop the industrial and institutional basis needed to benefit from the TRIPS-mandated level of patent protection.

Second, there is also a need to provide accommodation on substantive issues. The TRIPS Agreement accommodates the needs of developing countries by providing special

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[45] J. Janewa Oseitutu, "Value Divergence in Global Intellectual Property Law," (2012) 87 Ind. L.J. 1639 at 1664.
[46] *Supra* note 55 in chapter 6, at 694.
[47] Ituku Elangi Botoy, "From the Paris Convention to the TRIPS Agreement: A One-Hundred-and-Twelve-Year Transitional Period for the Industrialized Countries" (2004) 7:1 Journal of World Intellectual Property 115.
[48] *Supra* note 85 in chapter 4, at 293.

and differential treatment "in terms of time to comply rather than the level of compliance."[49] In other words, developing countries still have to comply with the substantive norms and procedure requirements of the Agreement, but at a slower pace of transition to TRIPS-compliant intellectual property regime. In addition, the TRIPS SDT provisions aim to enhance intellectual property rights awareness and facilitate TRIPS implementation and enforcement. They do not address more substantive issues such as a tiered application of patentability criteria for countries at different development levels.[50] In other words, TRIPS SDT provisions "moved from a nonreciprocal approach to obligations to a nonreciprocal approach to implementation."[51]

Jerome Reichman criticizes the absence of differential or more favourable provisions towards developing countries in TRIPS:

> Historically no poor country—no country that is developed at present—ever had to formulate their development strategies in the presence of the high international standards we have today. The 'technology divide' is widened by the absence of any provisions in international intellectual property agreements that would confer differential and more favorable treatment on developing countries. This is the first time in history that we have had a trade agreement without such differential or more favorable provisions. Thus these countries must compete in

[49] Christopher Arup, *The World Trade Organization Knowledge Agreements*, (Cambridge, UK: Cambridge University Press, 2008) at 318.

[50] Braga and Fink summarize: "In general, assistance to developing countries can be divided into four main areas: supporting the IPRs reform process, implementing reforms and building institutions, enhancing the environment for IPRs, and increasing the understanding of the social and economic effects of IPRs protection." See Carlos A. Primo Braga & Carsten Fink, "Reforming Intellectual Property Rights Regimes: Challenges for Developing Countries", (1998) Journal of International Economic Law 537 at 552.

[51] Jeffrey L. Dunoff, "Is the International Trade Regime Fair to Developing States?" (2003) 97 Am. Soc'y Int'l. L. Proc. 153 at 154. The rationale behind the "special and differential" treatment is that "equal treatment of unequal economies simply perpetuates economic inequality. To address this form of unfairness, S&D provisions are largely aimed at giving developing states preferential access to developed state markets and the ability to protect their own markets. They did so by creating exceptions to the basic GATT structure of nondiscrimination and reciprocity." *Ibid* at 153.

> markets for knowledge goods on roughly the same normative terms and conditions that govern advanced industrialized countries.[52]

Third, we need more effective mechanisms to increase incentives for technology transfer and technical assistance. Paragraph 11.2 of the Doha Decision on Implementation-Related Issues and Concerns mandated the TRIPS Council to develop "a mechanism for ensuring the monitoring and full implementation of the obligations [under Art. 66.2]".[53] In 2003, TRIPS Council adopted a decision putting in place the mechanism which requires developed country Members to submit detailed annual reports every third year and updates in the intervening years on detailed information on the functioning in practice of their incentives.[54] The mechanism is now in force and developed countries' reports are reviewed by TRIPS Council at the end of each year. However, it has been observed that developed countries' reports demonstrate a wide range of variance in terms of their respective understanding of "technology transfer" as well as the level of details.[55] An analysis of country submission to the TRIPS Council between 1999 and 2007 shows that Art. 66.2 has rather limited impact on creation of incentives for technology transfer to LDCs.[56] As a result, LDCs are critical of the level and effectiveness of the implementation of Art. 66.2: "While there has been some movement in implementing this commitment with some developed countries notifying to the Council for TRIPS the technology transfers that they have been

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[52] *Supra* note 100 in chapter 2; Jerome H. Reichman, "Does IP Harm or Help Developing Countries?" (2007) U. Ill. J.L. Tech. & Pol'y 101 at 108.
[53] Doha Ministerial Conference Decision on Implementation-Related Issues and Concerns, WT/MIN(01)/17, November 20, 2001, at para. 11.2.
[54] WTO document, "Implementation of Article 66.2 of the TRIPS Agreement: Decision of the Council for TRIPS of 19 February 2003", IP/C/28, February 20, 2003.
[55] Suerie Moon, "Does TRIPS Art. 66.2 Encourage Technology Transfer to LDCs?: An Analysis of Country Submission to the TRIPS Council (1999-2007)", UNCTAD-ICTSD Project on IPRs and Sustainable Development, Policy Brief No. 2, December 2008, online: < http://www.unctad.org/en/docs/iprs_pb20092_en.pdf>.
[56] *Ibid*.

involved in, the commitment has not yet been adequately fulfilled."[57] Therefore, it is necessary to design a more effective mechanism to report on the effectiveness of technology transfer, identify gaps between access to technology, and suggest guidelines and good practices from LDCs' perspectives.

Lastly, the key to fulfill the Art. 67 obligation is to develop individually tailored technical cooperation programs which focus on the technological strength and respond to specific needs of each developing country. WTO should collaborate with WIPO to undertake an assessment of the position of developing countries in global technology chains and knowledge-based innovation market.

Due to Members' unequal levels of development, the SDT principle is particularly important to ensure compliance with the patent provisions in TRIPS and in the meantime increase the innovation capability of all countries. International institutions should respect a country's autonomy in prioritizing its developmental agenda and take into consideration a country's level of development in international rule-making and norm-setting. In the words of Margot Salomon, substantive equality in international law can be understood as "a form of positive discrimination in favour of human development."[58] International innovation governance bodies have a positive obligation to prevent discriminatory effects of formal equality policies and ensure substantive equality and contribute to substantive freedom.

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[57] Communication from the Delegation of Zambia on behalf of the Least-Developed Country Members: Request for an Extension of the Transitional Period under Article 66.1 of the TRIPS Agreement, IP/S/W/457, October 21, 2005, at para. 6. See also, Kevin Kennedy, "The 2005 TRIPS Extension for the Least-Developed Countries: A Failure of the Single Undertaking Approach?", (2006) 40 Int'l Law. 683 at 699.

[58] Margot Salomon explains: "The Declaration on the Right to Development recognizes fully the need for a global approach to development to complement national action, and international cooperation directed at allowing diversity of development strategies and standards, perhaps conceived of as a form of affirmative action in favour of developing countries, might thus form an important way of giving effect to this right." *Ibid*., at 144.

As Christopher May points out, "[a]t a global level extending special and differential treatment would allow the balance between the private rights of developed country-based multinationals and the public-regarding welfare aspects in poorer developing countries to be restructured."[59] Equal treatment of patent protection with little regard to the imbalances between WTO Member States in terms of their innovation capabilities and development resources will inescapably perpetuate inequalities on other fronts.[60] Therefore, as the UN Millennium Project recommended, "intellectual property laws require a very delicate balance of market forces and public action—a balance unlikely to be the same for all countries" and called for IP norms to take into account the "levels of development and varying interests and priorities."[61] Thus, governments should have the freedom to implement TRIPS in a way that fits their development levels and technological differences.

All in all, trade-based and innovation-driven economic growth cannot be sustainable and equitable without effective mechanisms of special and differential treatment. The key to any effective mechanism of special and differential treatment is to be responsive to different levels of institutional and economic development, technological strength, industrial structure, and the specific needs and obligations under the multilateral trading regime. In addition, they should promote inter-agency collaboration between, e.g., WTO and WIPO, and inclusive participation of private actors and NGOs.

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[59] Christopher May, *The Global Political Economy of Intellectual Property Rights: The New Enclosures*, 2nd ed., (London: Routledge, 2010) at 89.
[60] Constantine Michalopoulos, "Special and Differential Treatment of Developing Countries in TRIPS" TRIPS Issues Paper No. 2, (Geneva: Quaker United Nations Office, 2003).
[61] The UN Millennium Project, *Investing in Development: A Practical Plan to Achieve the Millennium Development Goals*, at 219; see also, WIPO Committee on Development and Intellectual Property (CDIP), "Report on WIPO's Contribution to the United Nations' Millennium Development Goals (MDGs)", CDIP/5/3, February 26, 2010, at para. 7.

6.1.2 Implementing Differentiated Patent Schemes to Accommodate Technological Differences

This section illustrates the need for a tiered application of patentability criteria and patent terms to accommodate technological differences so that innovators in different technological fields can have equal opportunity to innovate. Simply put, patent systems are informed by a wide spectrum of technological, social, political and legal identifiers, making it almost impossible to crystallize and articulate with certainty the best model or level of patent protection in diverse technological settings. The unavoidable uncertainty of the patent system requires a tiered application of patentability criteria both within a country to increase patent quality, as well as internationally to reflect the technological standing of a certain country. With this proposition in mind, it is clear that the one-size-fits-all approach of patent law harmonization through the TRIPS Agreement, in which minimum standards of patent protection modeled on developed countries' IP systems have been imposed on developing countries, lacks legitimacy and practical applicability.[62]

Setting appropriate and differentiated patentability criteria helps to eradicate non-deserving patents and ensure that the reward to the inventor be proportionate to the contribution of the invention and the benefits to society. The patentability criteria of "novelty", "nonobviousness", and "utility" are terms that are not defined in TRIPS; therefore countries can define them in a way that narrows down the scope of claims according to their development priorities and innovation strategies. By adopting an absolute novelty standard, an inventor is not entitled to a patent if the invention disclosed in the application was publicly disclosed anywhere in the world prior to the date of his application. This is an

[62] See Peter Yu, "TRIPs and its Discontents" (2006) 10 Marq. Intell. Prop. L. Rev. 369 at 371-379.

effective way to protect traditional knowledge. Further, by requiring that patentees must add new technological art in order to meet the novelty standard, countries can avoid granting patents on the new uses of existing substances as the evergreening practice will prolong the patent monopoly without conferring extra benefits to the society. By raising the standard of nonobviousness, they can improve patent quality and mitigate trivial patents especially in areas such as biotechnology. It should also be noted that these terms "would be interpreted with reference to general practice and their normal linguistic import—but the range of defensible choice need not be construed in very narrow terms."[63] Patent authorities might be instructed to recognize only narrowly written claims in order to promote the ability of competitors to invent around patents. In this context, a system of utility models or petty patents, with significantly lower thresholds defining the "inventive step," is procompetitive in principle, for it encourages domestic incremental innovation.

Setting tiered patentability criteria and patent terms may seem to be contrary to Article 27.1, which requires that members have to make patents available to all fields of technology and cannot exclude from patent protection whole classes of inventions in certain fields of technology. According to the technology neutrality rule, members cannot impose different criteria for patent prosecution or different content or strength of patent rights in one field of technology but not in others. In fact, TRIPS jurisprudence has been marked by rigid interpretation of national treatment and non-discrimination as to the fields of technology. Panels have rejected the argument of substantive equality that differential treatment is in fact needed in certain circumstances to meet the requirement of non-discrimination.[64] I argue that

[63] *Supra* note 29 in chapter 6, at 105.
[64] Graeme B. Dinwoodie & Rochelle C. Dreyfuss, "TRIPS and the Dynamics of Intellectual Property Lawmaking," (2004) 36 Case W. Res. J. Int'l L. 95.

a holistic interpretation of TRIPS requires differential treatment of different technological fields in order to achieve substantive equality of innovation capability by accommodating innovators in different technological fields.

As the innovation literature suggests, technological differences should be taken into account when designing patent law and innovation policy. The one-size-fits-all principle cannot provide the incentives needed to stimulate innovation in different technological fields. Further, patents may not be a useful tool to promote innovation in certain industries or in countries below a certain level of development. Other types of intellectual property may be more effective to protect innovations and to appropriate values from investment under certain conditions. For example, trade secrets may be favoured by innovators when innovation is hard or costly to imitate.[65] In other words, the higher the ratio of the cost of inventing to the cost of imitation is, the more reliance on patents to protect her innovation an innovator will have.

Technologies have different characters. First, different technologies have different innovation cycles or progress generation: it takes different time periods for basic research and scientific discoveries in different technological fields to be commercially applicable and profitable. For example, the basic research discoveries can take 15 or 20 years to commercialize for electronics and communications, and 20 to 30 years for new materials.[66] Blonder argues that the current patent term of 20 years is too long for high tech, a generation of which is no more than 5 years, and too short for materials or life sciences. Instead, he

[65] Cristina Castelli, "Innovation," in Helge Hveem & Lelio Lapadre, eds., *The Global Governance of Knowledge Creation and Diffusion*, (London: Routledge, 2011) 65 at 68.
[66] See "Everyone Wants to Be a VC., An interview with Greg Blonder, AT&T Bell Labs ex-honcho", Business Week, (2 July 2002), (New York: Bloomberg), online: <http://www.businessweek.com/stories/2002-07-01/everyone-wants-to-be-a-vc-dot-dot-dot>.

suggests that "we should adjust the life span of patents to reflect economic and business realities, in the same way that we vary depreciation schedules."[67]

Second, different technologies respond to patent incentives differently. While pharmaceutical innovations depend a great deal on patent protection, innovations in electronics rely more on being the first produce, better meeting customer needs, and reducing costs.[68] I argue for the differentiation of protection levels according to the level of responsiveness a particular technological field is to patent incentives. How sensitive a particular patentable subject matter is to patent protection depends on a range of factors, including the nature of technological progress in certain fields, the innovation circle, the quality of patent administration, and the general business environment. It should be emphasized that the differentiation of protection level according to the sensitivity of a subject matter to patent incentives should not be considered a violation of TRIPS Article 27. The reason is that TRIPS Article 27 only prohibits discrimination between technological areas while the criterion used to differentiate in my proposal is their sensitivity to patent incentives.

6.2 Utilizing TRIPS Flexibilities to Promote Neutrality of Innovation Models

There are three types of TRIPS flexibilities that can be utilized to balance the patent system and non-proprietary innovation systems to a desirable ratio. First, countries should adopt the international exhaustion of patent rights and allow patent holders to voluntarily supply particular markets with their patented products. This will help build a healthy innovation environment in which customers not only enjoy better choices and lower prices,

[67] *Ibid*.
[68] *Supra* note 85 in chapter 4.

but also have access to patented technologies and an opportunity to innovate for themselves. Eric von Hippel observes that unrestricted access to products has resulted in important user innovation. Second, a statutory provision on compulsory licences can deter abusive exercises of patent rights. Third, adopting broad research and experimental use exceptions can enable follow-on innovators to conduct cumulative and sequential innovation.

6.2.1 Promoting User Innovation: International Exhaustion of Patent Rights

The exhaustion of patent rights refers to cases in which patent rights are deemed exhausted after first sale of the patented product by the right holder or with the right holder's consent. Parallel imports involve the import and resale in a country, without the consent of the right holder, of a protected product which was put on the market of the exporting country by the right holder or in another legitimate manner. It essentially limits the geographical boundary of the exercise of part of the patent rights bundle. In other words, the right holder maintains the exclusive right to manufacture the product but exhausts the right to control the resale of the product already sold by her or with her consent. Since companies usually charge lower prices for a patented product in one country than in another, a developing country can adopt international exhaustion and allow the purchase of a patented product abroad at a lower price, rather than buying it directly from an authorized importer in its domestic market at a higher price. This allows countries with limited resources to afford more of a patented product and facilitates access to essential goods such as patented medicine.

The doctrine of exhaustion is a mechanism to balance the exclusive intellectual property rights and the free flow of goods and services in the market by putting a stop to the control of the intellectual property right holder over the resale or further disposition of the

intellectual property-protected product after its first lawful sale by the right holder or with her consent. If all business transactions are within a national market, the exhaustion of intellectual property rights occurs when products incorporating intellectual property are placed on the national market with the consent of the right holder. Countries may adopt different exhaustion rules for different types of intellectual property rights. In a patent context, the first lawful sale of a patented product or a product obtained by means of a patented process "frees it from the protection of the patent right."[69]

The doctrine of exhaustion becomes complex with the integration of markets and liberalization of international trade. Prior to TRIPS, pursuant to the independence of rights principle under the Paris Convention, the norm was the national exhaustion doctrine, that is, the lawful sale of an intellectual-property-protected product in one Member did not exhaust a parallel intellectual property right in another Member; and thus the holder of a parallel intellectual property right in the other Member may prevent the importation of the product.[70] The national exhaustion doctrine gives the intellectual property right owner more market power to control the competition environment, by for example prohibiting parallel importation, and hence facilitates the development of marketing strategies targeting a specific market segment. The national exhaustion doctrine maximizes the incentives to create and innovate and the returns on investment from commercializing creations and inventions.

[69] Carvalho, *The TRIPS Regime of Patent Rights*, at 108.
[70] Pursuant to the independence of rights principle contained in Paris Convention Article 4bis, a patent granted for a particular invention in any of the member countries shall be independent, in scope, term and validity, of all other patents acquired with respect to the same invention in other member countries. *Supra* note 2 in chapter 1.

Under the international exhaustion doctrine, a parallel intellectual property right is exhausted upon the first lawful sale anywhere in the world of the product incorporating the IP right; and thus the holder of a parallel IP right is not able to control its importation. In effect, a product may move freely in the worldwide market following its first lawful sale without the authorization of the IP right holders. The doctrine of international exhaustion allows the importation and marketing of lawful products without contractual arrangements with the right holder and is likely to increase competition and reduce consumer prices.[71] To a certain extent, the international exhaustion doctrine is more consistent with the trade liberalization objective of the WTO and increases the efficiency of resource allocation in the world market.[72]

In addition to national and international exhaustion, the European Union follows a regime of regional exhaustion, meaning that an intellectual property owner's right to control the resale of a product embodying the IP is exhausted within the region once the owner sells or authorizes the sale of the product within the region.

WTO Members could not agree on uniform rules regarding the scope of the exhaustion doctrine.[73] Article 6 excludes from dispute settlement the issue of exhaustion of rights and thus allows Members to adopt their own policies and rules on the scope of the exhaustion doctrine. However, the exclusion from dispute settlement does not mean a

[71] Frederick M. Abbott, "First Report (Final) to the Committee on International Trade Law of the International Law Association on the Subject of Parallel Importation" (1998) 1 Journal of International Economic Law 607.
[72] K. Verma, "Exhaustion of Intellectual Property Rights and Free Trade—Article 6 of the TRIPS Agreement" (1998) 29:5 IIC 534-567.
[73] See Frederick M. Abbott, "First Report (Final) to the Committee on International Trade Law of the International Law Association on the Subject of Parallel Importation", (1998) 1 J. Intl. Econ. L. 607 at 613.

dispute concerning exhaustion rules would never arise because Members may define the term "exhaustion" broadly or narrowly.[74]

Adrian Otten, who served as Secretary to the Trade Negotiating Group during the Uruguay Round negotiations, pointed out that: "The formula in Article 6, TRIPS Agreement, reflects a compromise between governments favouring an explicit recognition of national discretion in regard to exhaustion practices, including the choice of national or international exhaustion, and governments not wanting to provide such recognition although not seeking to regulate such practices specifically."[75]

Frederick Abbott makes three observations regarding Article 6 in his final report on the subject of parallel importation:[76]

- the subject of exhaustion of IPRs and parallel imports was not inadvertently overlooked;
- TRIPS negotiators failed to reach a consensus on the subject; and
- having failed to reach a consensus on result, each WTO Member reserves the right to regulate parallel imports in the manner it considers appropriate.

Article 6 should be properly understood with two limits in mind. First, the issue of exhaustion of rights is only excluded from dispute settlement and not from the TRIPS Agreement altogether.[77] In fact, Article 6 specifically subjects the application of exhaustion rules to Article 3 and 4 (national and MFN treatment provisions). At a minimum, exhaustion rules shall be applied on a non-discriminatory and consistent basis.

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[74] UNCTAD Course on Dispute Settlement, at 8.
[75] Remarks of Adrian Otten in Frederick M. Abbott, Second Report (Final) to the Committee on International Trade Law of the International Law Association on the Subject of the Exhaustion of Intellectual Property Rights and Parallel Importation, presented in London, July 2000, at the 69th Conference of the International Law Association.
[76] Frederick M. Abbott, Final Report, at 609.
[77] Daniel Gervais, *The TRIPS Agreement*, *supra* note 5 in chapter 1, at 198.

The treatment of exhaustion of rights in the TRIPS Agreement as provided in Article 6 and paragraph 5(d) of the Doha Declaration has important implications for the limitation on the exclusive rights of intellectual property right holders. Paragraph 5(d) of the Doha Declaration on the TRIPS Agreement and Public Health affirms unequivocally that each Member is entitled to allow international exhaustion and parallel importation of IPRs protected goods.[78] Generally, the choice of exhaustion doctrine depends on the calculation of the benefits to the intellectual property right holders and costs of higher prices for IP goods on consumer welfare. Since developing countries are mostly users and importers of intellectual property products, they prefer international exhaustion doctrine in order to protect their domestic consumers and public interests.[79]

The WIPO study shows that 29 of the 112 countries studied have an international exhaustion regime, 36 have a regional exhaustion regime, and 42 have a national exhaustion regime.[80] WTO members with lesser innovation capability are encouraged to adopt the international exhaustion of patent rights and allow parallel importation.

6.2.2 Ensuring a Fair Exercise of Patent Rights: Compulsory Licences

TRIPS minimum standards restrict members' freedom to promote competition through imitation and reverse engineering that an optimal innovation system would allow. As a result, the balance between free competition and patent monopoly is tilted towards the

[78] Paragraph 5(d) of the Doha Declaration reads: "The effect of the provisions in the TRIPS Agreement that are relevant to the exhaustion of intellectual property rights is to leave each Member free to establish its own regime for such exhaustion without challenge, subject to the MFN and national treatment provisions of Articles 3 and 4". See WTO document WT/MIN(01)/DEC/2, November 20, 2001.
[79] M. Slotboom, "The Exhaustion of Intellectual Property Rights" (2003) 6:3 Journal of World Intellectual Property 421-440.
[80] WIPO, "Patent-Related Flexibilities in the Multilateral Legal Framework and Their Legislative Implementation at the National and Regional levels" (Geneva: WIPO, 2010).

latter. Abusive exercise of patent rights can stifle innovation and endanger a fair competition environment.[81] Compulsory licensing is an important tool to deter distorting effects of patent abuse and ensure a fair exercise of patent monopoly. It encourages collaboration-oriented licensing practice, controls the manipulation and abuse of patent rights, and promotes efficient use of innovation resources. TRIPS Article 31 stipulates specific conditions that must be met before a compulsory licence can be issued. These conditions are: (1) grant of compulsory licences must be made on a case-by-case basis; (2) non-exclusivity and non-assignability; (3) attempt must be made to obtain authorization from the rightholder on reasonable commercial terms and conditions prior to the grant of a compulsory licence; (4) compulsory licences must be limited in both duration and scope; (5) the payment of adequate remuneration; (6) compulsory licences must be limited to predominantly supply the domestic market; (7) judicial review must be available.

Utilizing TRIPS flexibilities in compulsory licensing, countries can authorize, in their patent and competition legislation, the use of a dominant or blocking patent by the government (non-commercial) or third parties (to supply the market in the public interest) without the consent of the right holder. TRIPS art. 31(l) authorizes countries to grant compulsory licenses to the owner of a "dependent" patent that cannot be practiced without infringing another patent.[82]

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[81] To quote the Supreme Court of Canada on this point: "Excessive control by holders of copyrights and other forms of intellectual property may unduly limit the ability of the public domain to incorporate and embellish creative innovation in the long-term interests of society as a whole, or create practical obstacles to proper utilization." *Théberge v Galerie d'Art du Petit Champlain Inc*, [2002] 2 SCR 336, at 32.

[82] TRIPS art. 31 (l) reads: "where such use is authorized to permit the exploitation of a patent ("the second patent") which cannot be exploited without infringing another patent ("the first patent"), the following additional conditions shall apply:

(i) the invention claimed in the second patent shall involve an important technical advance of considerable economic significance in relation to the invention claimed in the first patent;

Compulsory licences can be issued on various grounds of public interest, such as public health and control of anti-competitive practices. Since the term "anti-competitive practices" is not defined in TRIPS, members have significant flexibility to determine what they consider to be anti-competitive. Article 8.2 provides that steps may need to be taken "to prevent the abuse of intellectual property rights by right holders." Article 31(k) exempts members from legislating certain conditions attached to the grant of compulsory licences where such licences are issued to remedy a practice determined after judicial or administrative process to be anti-competitive. Article 40 permits members to employ whatever competition enforcement they consider necessary subject to permitting opportunities for administrative review and bilateral consultations. Article 40(2) acknowledges the legitimate interest of Members in addressing "licensing practices or conditions that may in particular cases constitute an abuse of intellectual property rights having an adverse effect on competition in the relevant market." TRIPS recognizes that licensing practices or conditions may have adverse effects on trade and may impede the transfer and dissemination of technology

6.2.3 Broad Research and Experimental Use Exceptions

Patent law's central tenet is to achieve a balance between incentivizing innovation through protecting patentee's rights to maximize economic returns anticipated from market exclusivity; and allowing the derogation of such rights in the service of the public interest in accessing knowledge and defending social values and public morals. Therefore, general

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(ii) the owner of the first patent shall be entitled to a cross-licence on reasonable terms to use the invention claimed in the second patent; and
(iii) the use authorized in respect of the first patent shall be non-assignable except with the assignment of the second patent.

norms and specific rules of exceptions are the most important legal instrument for achieving a balanced patent regime.

I argue that Article 30 should be interpreted broadly to protect the fundamental freedom to innovate and advance the public interest in accessing equally the innovation commons. In particular, countries should be allowed to permit limited use for research and experiment. The value of scientific research increases when combined with practical actions. In addition, it protects the fundamental freedom of users to innovate. It has been confirmed by the WTO Panel that in accordance with TRIPS Article 30, members may provide a limited exception that allows the use of a patented invention without the authorization of the rightholder for the purpose of encouraging domestic research and local innovation capability.[83] This may enable domestic innovators to experiment with (e.g. testing and establishment of the bioequivalence of generic version) the patented invention before expiry of the patent, make further improvement, or adapt it to the local conditions.

Canada—Pharmaceutical Patent is a WTO dispute between Canada and the EU regarding the conformity of two exceptions provided under the Canadian Patent Act, namely, a regulatory review exception (section 55.2(1)) and a stockpiling exception (section 55.2(2)), with Canada's obligations under the TRIPS Agreement. The regulatory review exception, which was found by the Panel to be compatible with TRIPS, allowed generic producers to manufacture pharmaceuticals and carry out experiments required for the regulatory review process prior to the expiration of the patent term. The stockpiling exception, which was found by the Panel to be incompatible with TRIPS, allowed generic

[83] Canada-Pharmaceutical Patent, *supra* note 175 in chapter 6.

producers to manufacture and store the patented drugs during the term of the patent in order to enter the market upon the expiration of the patent term.

The Panel considered that Article 30 establishes three criteria which must be met in order to qualify for an exception: (1) the exception must be "limited"; (2) the exception must not "unreasonably conflict with the normal exploitation of the patent"; and (3) the exception must not "unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties."[84] The Panel emphasized that "[t]he three conditions are cumulative, each being a separate and independent requirement that must be satisfied. Failure to comply with any one of the three conditions results in the article 30 exception being disallowed."[85]

A statutory research exemption provision will relieve the restraints that the proliferation of trivial patents has placed on non-commercial research. The exemption will allow researchers, even with limited financial resources, to access the latest inventions and discoveries without worrying about infringing others' patents. The research community as a whole will benefit from the freedom to work with and build on patented technologies.

6.3 Utilizing TRIPS Flexibilities to Cultivate an Accessible Innovation Commons

The ability to liberally access and affordably utilize knowledge in an innovation commons is crucial to continuously improve the state of the technological art and to spur follow-on innovation. An innovation commons can be seen as the collective property of society from which innovators draw the raw materials to fashion their innovation. A broad

[84] Panel Report, *Canada—Pharmaceutical Patent*, *supra* note 175 in chapter 6, at para. 7.20.
[85] *Ibid*., at para. 7.20.

and freely accessible innovation commons is important to safeguard individuals' freedom to innovate and cultivate innovation capability for the community as a whole. Vaver notes: "Keeping a broad public domain itself encourages experimentation, innovation, and competition—and ultimately the expectation of lower prices, better service, and broader public choice."[86]

In order to build an open and vibrant innovation commons, countries should implement TRIPS in a manner that restricts patent claims on morally objectionable subjects and raw innovation resources, and that ensures sufficient disclosure in patent specification. The first proposal focuses on restricting what can be patented so as to conserve foundational knowledge and scientific principles in the innovation commons and to protect basic human rights and public order. The second proposal relates to making sure that the patent bargain is fair to the society. As Harold Fox notes, "the inventor must, in return for the grant of a patent give to the public an adequate description of the invention with sufficiently complete and accurate details as will enable a workman, skilled in the art to which an invention relates, to construct or use that invention when the period of the monopoly has expired."[87]

6.3.1 Restricting the Scope of Patentable Subject Matter

Patents should only be granted to the technical application of an innovative idea that is not contrary to morality or ordre public; and that promotes ingenuity and social progress. Two underlying principles in defining the scope of patentable subject are (1) the basic human dignity, integrity, and human rights shall not be undermined by patents; and (2) the

[86] Vaver, *Intellectual Property Law*, *supra* note 25 in chapter 4, at 23.
[87] Harold Fox, *Canadian Patent Law and Practice Relating to Letters Patent for Inventions*, 4th ed. (Toronto: Carswell, 1969) at 163.

basic building blocks of knowledge should be open and free for all to use on an equal term, without the interference of patent rights.

This section argues that WTO members have an obligation to scrutinize the subject matter of a patent application prudently to ensure that it falls under an appropriately narrow definition of "patentable subject matter". In particular, members have the flexibilities to exclude four categories of subject matter specifically permitted under TRIPS Articles 27.2 and 27.3 entirely from patent protection for moral and public policy reasons: (1) non-inventions, such as pre-existing substances in nature; (2) non-technical subject matters; (3) certain medical related exclusions permissible under Article 27.3(a); and (4) certain subject matters whose commercial exploitation may be contrary to morality or ordre public, including contrary to international human rights laws and norms.

6.3.1.1 Non-Inventions

The first ground for exclusion is that the subject is not an invention. An invention should be a new technical product or process created by man in the course of transforming nature and human societies. There are generally two approaches to define "invention" in national and regional patent laws. The first approach is to provide a positive definition of invention in patent statutes.[88] For example, s. 2 of the Canadian Patent Act provides: "'invention' means any new and useful art, process, machine, manufacture or composition of matter, or any new and useful improvement in any art, process, machine, manufacture or

[88] For instance, the Mexican patent law regards invention as "all human creation that permits the transformation of matter or energy that exists in nature, for the benefit of man and to satisfy his concrete needs." See Carlos M. Correa, *Trade Related Aspects of Intellectual Property Rights: A Commentary on the TRIPS Agreement*, (Oxford, UK: Oxford University Press, 2007) at 271 fn 2. Similarly, Article 2(1) of the Patent Law of Japan defines "invention" as a highly advanced creation of technical ideas by which a law of nature is utilized. Article 2 of the Chinese Patent Law defines "invention" as "any new technical solution relating to a product, a process or an improvement thereof." See Chinese Patent Law, as amended 2008.

composition of matter."[89] The second approach is to specify an exhaustive or non-exhaustive list of subject matters that are not invention. For instance, Article 52(2) of the *European Patent Convention* (EPC) contains a non-exhaustive list of subject matters which are not regarded as inventions: "(a) discoveries, scientific theories and mathematical methods; (b) aesthetic creations; (c) schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers; (d) presentation of information."[90]

The TRIPS Agreement does not positively define a "patentable invention", but simply excludes certain general categories from patentability. Article 27.1 provides that Members shall make patents available, subject to certain exclusions, to applicants for any invention, whether product or process, in all fields of technology, provided that the three patentability criteria are met, namely, novelty, non-obviousness (or inventive step), and utility (or industrial applicability). Therefore, WTO members have limited flexibility under Article 27.1 to exclude from patentability certain subjects either because they do not fall within the definition of "invention" or these inventions are not considered patentable. They can do so by defining the scope of patentable invention either as a matter of statutory subject matter exemption or judicial interpretation. For example, in Canada, statutory exclusions from patentability are based on "mere scientific principle or abstract theorem".[91] Common

[89] *Patent Act*, R.S.C., 1985, c. P-4, s. 2.

[90] See European Patent Convention (EPC), 14th ed., online: <http://documents.epo.org/projects/babylon/eponet.nsf/0/7bacb229e032863dc12577ec004ada98/$FILE/EPC_14th_edition.pdf>. See also, WIPO, "Exclusions from Patentable Subject Matter and Exceptions and Limitations to the Rights", SCP/13/3, (Feb. 4, 2009), online: WIPO <http://www.wipo.int/edocs/mdocs/scp/en/scp_13/scp_13_3.pdf> at 7.

[91] Section 27(8) of the Canadian Patent Act provides: "No patent shall be granted for any mere scientific principle or abstract theorem." See *Patent Act*, R.S.C., 1985, c. P-4, s. 27(8).

law exclusions from patentability (such as higher life forms) are based on judicial interpretation of core terms in sections 2 and 27(8).[92]

It should be emphasized that the mere discovery of pre-existing substances or natural phenomena, if not put to practical use, has long been excluded from patent protection.[93] The rationale for such exclusion is that these subjects are part of the "common heritage of mankind" and should be in the public domain. As such, granting monopoly over them would impede new inventions and technological improvements. The distinction between discovery and invention does not stem from the significance to technological progress, efforts and money invested, or intelligence needed. The distinction is that a discovery is the uncovering of objective natural phenomena or property, or casual relationships belonging to all men while an invention is the development of a *concrete* and *practical* solution by exerting human ingenuity and applying *technical* means on common information and property.[94]

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[92] Arbour J. distinguishes exclusions from patentable subject matter based on statutory exceptions from those that result from judicial interpretation, stating: "Subject matters that are specifically precluded by statute from patent protection are natural phenomena, laws of nature, and scientific principles: s. 27(8). Other subject matter has been excluded by judicial interpretation of s. 2 definitions of "invention" and "process" and s. 27(8). For example, the following have been excluded: computer programs if the discovery involved is a method of calculation [...]; methods of medical treatment[...]; higher life forms [...]; business systems and methods and professional skills and methods [...]; printed matter producing only an artistic intellectual or literary result [...] mere human conduct or mental steps, or instructions [...]; and architectural plans. These examples demonstrate that it is not unusual for courts and the Patent Office to interpret provisions of the Patent Act so as to exclude subject matter from patentability." See *Monsanto Canada Inc. v. Schmeiser*, [2004] 1 S.C.R. 902, 2004 SCC 34, at para. 133 *per* Arbour J dissenting in part.

[93] The US Supreme Court held in 1980 in *Diamond v Chakrabarty* that: "The laws of nature, physical phenomena, and abstract ideas have been held not patentable … Thus, a new mineral discovered in the earth or a new plant found in the wild is not patentable subject matter. Likewise, Einstein could not patent his celebrated law that E=mc2; nor could Newton have patented the law of gravity. Such discoveries are "manifestations of … nature, free to all men and reserved exclusively to none." See *Diamond v Chakrabarty*, 447 U.S. 303, 309 (1980) (citations omitted). For a complete explanation see Luigi Palombi, "The Patenting of Biological Materials in the Context of the Agreement on Trade-Related Aspects of Intellectual Property Rights," (2004) Ph.D thesis submitted to the Law School of the University of New South Wales, online: <http://works.bepress.com/cgi/viewcontent.cgi?article=1003&context=luigi_palombi>.

[94] See Carlos Maria Correa, *Intellectual Property Rights, the WTO and Developing Countries*, (London: Zed Books & Third World Network, 2000).

However, it is increasingly difficult to draw the line between a patentable invention and a preexisting discovery, particularly in the field of genetic research and biotechnological inventions. For example, will a gene or gene sequence be patentable if a researcher discovers a gene without modifying it and identifying its specific functions? TRIPS Article 27.3(b) provides considerable flexibility for WTO members to exclude from patentability of plants and animals other than microorganisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes.

There have been controversies how to implement this exception in practice. Under some countries' patent laws and practices, gene sequences are considered refined or isolated from naturally occurring substances and thus eligible for patenting. For example, the United States has established the principle that anything made by man applying "law of nature" falls within the definition of "invention". If a pre-existing substance can be practically applied to produce a technical effect and real world utility, it may be patentable.[95] Therefore, an isolated and purified form of pre-existing substances (e.g., biological materials) is considered an "invention" and thus patentable. Other Members, such as Brazil, stipulates that no patents shall be granted with respect to "natural living beings and biological materials found in nature", even if isolated, including the "genome or germplasm of any natural living being, and the natural biological processes."[96]

[95] For example, the US Supreme Court held that phenomena of nature "are manifestations of laws of nature, free to all men and reserved exclusively to none. … If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end." See *Funk Brothers Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127 (1948), 76 USPQ 280, at 130. See also, Guidelines for Examination in the EPO, Chapter IV, 2.3.1.

[96] Article 10 of the Brazilian Industrial Property Law provides: "The following are not considered to be inventions or utility models: … IX. all or part of natural living beings and biological materials found in nature, even if isolated therefrom, including the genome or germoplasm of any natural living being, and the natural biological processes." Article 10.IX., Law No. 9.279 of May 14, 1996 (Industrial Property Law), available

I argue that a close examination of Article 27.3(b) suggests that members should be free to narrow the scope of patentable subject matter in connection with plants and animals to microorganisms and non-biological and microbiological processes. Further, the term "microorganism" should be narrowly defined to exclude mere genetic discoveries and to require genetic modification or genetic engineering.[97] In order for subject matter of natural origin to be patentable, there must be something new, either a new form, or a new quality, that has been imparted to the original product existing in nature through human intervention and manipulation.[98] Along this line of thinking, gene patenting should only be permissible as an exception to the general rule that mere genetic discoveries may not be considered microorganisms and thus unpatentable. This restrictive approach is justified by serious ethical and public health concerns raised by gene patents. The social cost of patenting a disease gene is very high because the right holder controls any diagnostic or therapeutic use of the gene and can block subsequent research utilizing the gene.[99]

Another reason why the definition of microorganism should be narrow is to help those developing countries that are rich in genetic resources to preserve the flexibility needed to experiment with different approaches to genetic resources protection.[100] TRIPS-mandated minimum standards for the protection of genetic resources often ignore the communal interests and ownership over indigenous innovations. This contradicts the

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online: <http://www.wipo.int/wipolex/en/text.jsp?file_id=125397>. See also, Carlos M. Correa & Sisule F. Musungu, "The WIPO Patent Agenda: The Risks for Developing Countries", South Centre, (November 2002), online: <http://www.southcentre.org/index.php?option=com_content&task=view&id=76&Itemid=67> at 18.

[97] *Supra* note 51 in chapter 6, at 393.

[98] George Francis Takach, *Patents: A Canadian Compendium of Law and Practice*, (Edmonton: Juriliber, 1993) at 34.

[99] Lori B. Andrews, "The Gene Patent Dilemma: Balancing Commercial Incentives with Health Needs," (2002) 2 Hous. J. Health L. & Pol'y 65. Andrews notes: "Granting patent monopolies in this field has a much higher social cost than, for example, patenting a marginally better mousetrap or some other invention where consumers can readily choose a substitute or do without." *Ibid*., at 70.

[100] *Supra* note 147 in chapter 4, at 266.

requirement of Article 8(j) of the Convention on Biological Diversity, which requires contracting parties to "respect, 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."[101] By adopting a narrow definition of microorganism, developing countries can prohibit the patenting of genetic materials in certain circumstances where patenting will increase costs for agricultural products, threaten food security and environmental sustainability, and reduce diversity in traditional agricultural practices.[102]

Moreover, members can exclude from patentability "essentially biological processes for the production of plants or animals". The terms of "essentially biological", "non-biological" and "micro-biological" should be defined according to the degree of technical intervention involved in creating the process:

> The greater the need for intervention, the less likely the process is to be classified as 'essentially biological' and the more likely it is to be patentable. In contrast non-biological and microbiological process refers primarily to a therapeutic treatment of plants that is generally recognized as patentable in Europe. Microbiological processes are harder to define; generally, they are thought to involve the use of microorganisms such as 'viruses, algae, bacteria and even cells or cell lines,' although the definition of a microorganism may vary by country.[103]

In addition, Article 27.3(b) should be considered in light of States' international human rights obligations especially the right to health and the right to food. However, members must provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by a combination thereof. Under a TRIPS *sui generis* system,

[101] CBD, *supra* note 110 in chapter 4.
[102] Rhys Manley, "Developmental Perspectives on the TRIPS and Traditional Knowledge Debate", (2006) 3 Macquarie J. Int'l & Comp. Envtl. L. 113 at 126.
[103] Carrie P. Smith, "Patenting Life: The Potential and the Pitfalls of Using the WTO to Globalize Intellectual Property Rights," (2001) 26 N.C.J. Int'l L. & Com. Reg. 143 at 162.

states have the freedom to set the eligible criteria for protection; the scope; genera; and species that may be protected; exemptions to the exclusive rights; and compulsory licensing provisions.[104] Although there are other models of *sui generis* systems, it is advisable for members with weak innovation capabilities to protect plant varieties by following the general framework of the International Convention for the Protection of New Varieties of Plants (UPOV). In particular, countries may provide for a breeders' exemption and a farmers' right.[105]

6.3.1.2 An Invention should be of an Applied and Concrete Technical Nature

The second ground for exclusion is concerned with the principle that inventions should be of an applied and concrete technical nature. Members have the freedom to specify the technical character requirement in their patent laws and exclude from patentable inventions "non-technical" subject matters.

It is a general rule that an invention shall be of a technological nature. For example, according to EPC Rule 42(1)(a) and (c) and Rule 43(1), "the invention must be of "technical character" to the extent that it must relate to a technical field, must be concerned with a technical problem, and must have technical features in terms of which the matter for which protection is sought can be defined in the claim."[106] TRIPS Article 27.1 also provides that "patents shall be available for any inventions, whether products or processes, in *all fields of*

[104] See Maristela Basso & Edson Beas Rodriguez, Jr., "Free Trade Agreements, UPOV and Plant Varieties" in Christopher Heath & Anselm Kamperman Sanders, eds., *Intellectual Property and Free Trade Agreement*, 171 at 191.
[105] Chidi Oguamanam, *International Law and Indigenous Knowledge: Intellectual Property, Plant Biodiversity and Traditional Medicine*, (Toronto: University of Toronto Press, 2006).
[106] See Guidelines for Examination in the EPO, Chapter IV, 1.2(ii).

technology."[107] Thus, aesthetic creations and methods of performing mental acts or doing business are generally not considered to be inventions.[108] Further, members may exclude computer programs as they are protected as literary devices under TRIPS.

In addition, an invention should not be an abstract idea but should embody the practical and concrete application of such ideas. Scientific principle and abstract theorem are unpatentable because they belong to the public domain of scientific knowledge.[109] It would defeat the purpose of promoting innovation and development if we afford patent protection to pure ideas "without a material form or a practical application."[110]

6.3.1.3 Medical-related Exception

The third ground for exclusion is certain medical related exclusions permissible under Art. 27.3(a). Pursuant to Art. 27.3(a), Members are allowed to exclude from patentability "diagnostic, therapeutic, and surgical methods for the treatment of humans and animals." The EPC and the Japanese Patent Act are among many patent laws which exclude therapeutical or surgical treatments as well as diagnostic methods practiced on the human body from patentable inventions.[111] This exception aims to promote wide dissemination of

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[107] TRIPS, *Supra* note 1 in chapter 1, Article 27.1 (emphasis added).
[108] Art. 52(2) of the European Patent Convention specifically excludes from patentable inventions "schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers ..." See European Patent Convention, online: <http://documents.epo.org/projects/babylon/eponet.nsf/0/E4F8409B2A99862FC125736B00374CEC/$File/EPC_13th_edition.pdf>. See WIPO, "Exclusions from Patentable Subject Matter and Exceptions and Limitations to the Rights", SCP/13/3, (Feb. 4, 2009), online: WIPO <http://www.wipo.int/edocs/mdocs/scp/en/scp_13/scp_13_3.pdf> at 7.
[109] Section 27(8) of the *Canadian Patent Act* provides: "No patent shall be granted for any mere scientific principle or abstract theorem."
[110] Alan L. Durham, *Patent Law Essentials: A Concise Guide*, 2nd ed., (Westport, Connecticut: Praeger, 2004) at 24.
[111] EPC Art. 52 (4); JPO's Implementing Guidelines for examination of Industrially Applicable Inventions, section 2.1.

medical innovations and advance public interest.[112] The policy reason behind the exclusion of medical methods from patentability is that they are essentially not related to industry and commerce and hence lack industrial applicability. In addition, allowing an area of professional skills to be monopolized is not conducive to public health and medical advancement. However, it should be emphasized that apparatus, substances, and compositions associated with diagnostic and therapeutic methods, such as kits for application in a diagnostic method, can be protected.[113]

6.3.1.4 Morality and Ordre Public Exception

The fourth ground for exclusion is based on the fact that the commercial exploitation of certain subject matters are contrary to morality or ordre public, including contrary to international human rights laws and norms. For example, biotechnology is closely connected to human health and dignity and thus has critical ethical and moral implications.

TRIPS Article 27.2 authorizes Members to deny patent protection altogether based on legitimate health and environmental concerns when it is necessary to prevent commercial exploitation which would violate ordre public or morality. It excludes innovations from patentability to protect human, animal, or plant life or health or to avoid serious prejudice to the environment.[114] However, an important proviso is that the use of this exception is subject

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[112] Group of Negotiations on Goods (GATT) Negotiating Group on Trade-Related Aspects of Intellectual Property Rights Including Trade in Counterfeit Goods, Communication from Argentina, Brazil, Chile, China, Colombia, Cuba, Egypt, India, Nigeria, Peru, Tanzania, Uruguay & Pakistan, MTN.GNG/NG11/W/71, ch. 2, arts. 4(1)-4(2) (1990), in Carlos M. Correa & Abdulqawi A. Yusuf, eds., *Intellectual Property and International Trade: The TRIPS Agreement*, (London: Kluwer Law International, 1998) at 441, 446.

[113] Ana Maria Pacon, "What will TRIPS do for Developing Countries?" in Beier & Schricker, *From GATT to TRIPS*, *supra* note 39 in chapter 5, at 339.

[114] Article 27.2 provides that 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."

to the condition that the commercial exploitation of the invention must be prevented and that this prevention must be necessary for the protection of ordre public or morality. Two points need to be highlighted in order to properly understand this proviso. First, the exclusion must be made based on the impact of commercial exploitation of the invention within the territory of the country concerned. In other words, the proviso would not be satisfied if a Member excludes certain subject-matter while permitting its commercial exploitation (e.g., distribution and sale) within its jurisdiction.[115] Second, the exclusion from patentability is reliant on a risk that the commercial exploitation within the territory of the concerned WTO Member of the invention could endanger ordre public or morality; rather than a scientific proof that the commercial exploitation of the invention does result in such danger.

The moral criteria of patenting have been rarely considered in patent examination or been narrowly construed. For example, the European Patent Office interprets Article 53(a) of the European Patent Convention, which prohibits the grant of patents that would be contrary to "ordre public or morality", as only excluding patents whose exploitations would be "abhorrent to the overwhelming majority of the public" or a contravention of the "totality of accepted norms." I argue that Article 27.2 should be broadly applied and WTO members are free to define the term "ordre public" under their national laws and jurisprudence. Professor David Vaver has proposed that special ethics and public interest panels be established, independent of the patent offices, to decide whether a particular invention qualifies as patentable subject matter.[116] Article 27.2 exceptions reaffirm the understanding that

[115] Carlos Correa, "The GATT Agreement on Trade-Related Aspects of Intellectual Property Rights: New Standards for Patent Protection", (1994) 16 European Intellectual Property Review 327-329.

[116] David Vaver, "Invention in Patent Law: A Review and a Modest Propopsal" (2003) 11 Int'l J. L. & Info. Tech. 286 at 306-307. David Vaver advocates for the public interests: "Patents should work manifestly in the public benefit—the ultimate justification for the system. The public pays a high price for patents....Therefore the legislation should be amended to exclude inventions that it would not be in the public interest to patent—in

intellectual property rights are qualified and may be subject to competing interests that may be more important than exclusive patent rights. And international human rights law and norms, including human rights to development and freedom of commerce, should be a source for defining ordre public and morality.

In sum, the scope of patentable subject matter should balance the need to provide incentives to research and innovation and the need to facilitate knowledge diffusion and wider access. The purpose of the balancing act is to minimize the cost of TRIPS compliance while maximizing the potential of TRIPS for innovation stimulation.

6.3.2 Ensuring Sufficient Disclosure

This section argues that patent offices should be required to examine patent specifications more stringently to ensure the standards of sufficient disclosure are met. Applying the standard of sufficient disclosure embodied in TRIPS article 29.1, a country can impose stringent rules on patent disclosure and require the disclosure to be sufficiently clear and comprehensive for a skilled person in the related activity to reproduce the inventive step.[117] Or it could require the description of the production process, or that the disclosure be free of technical jargon so that a lay person would be able to understand and utilize the information.[118] In addition, patent applicants should be required to disclose the origin of

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effect, a return to the principle of excluding 'generally inconvenient' patents, but one where the issue of 'convenience' or 'public interest' is seriously weighed and considered." *Ibid*., at 305.

[117] TRIPS Article 29.1 requires disclosure of the invention "in a manner sufficiently clear and complete for the invention to be carried out by a person skilled in the art and may require the applicant to indicate the best mode for carrying out the invention known to the inventor at the filing date or, where priority is claimed, at the priority date of the application."

[118] WIPO Committee on Development and Intellectual Property (CDIP), "Patent-related Flexibilities in the Multilateral Legal Framework and Their Legislative Implementation at the National and Regional Levels", (March 1, 2010), CDIP/5/4, at 12.

genetic resources and the traditional knowledge used in the invention in order to ensure compliance with access and benefit sharing requirements.[119]

The validity of the patent bargain lies on a fair social contract: the public must get something in return for the exclusive protection and limited monopoly that a patent confers. As Justice Binnie states: "Disclosure is the *quid pro quo* for valuable proprietary rights to exclusivity which are entirely the statutory creature of the Patent Act."[120] The consideration on which a patent is granted is a new, non-obvious, and useful invention that teaches new technological information to the public and offers them the freedom to use the invention after the patent expires. In this sense, insufficient disclosure of the invention fails to perform the consideration and invalidates the patent grant.[121]

In *Teva Canada Ltd. v. Pfizer Canada Inc.*, Justice LeBel held:

> However, the public's right to proper disclosure was denied in this case, since the claims ended with two individually claimed compounds, thereby obscuring the true invention. The disclosure failed to state in clear terms what the invention was. Pfizer gained a benefit from the Act — exclusive monopoly rights — while withholding disclosure in spite of its disclosure obligations under the Act. As a matter of policy and sound statutory interpretation, patentees cannot be allowed to "game" the system in this way. This, in my view, is the key issue in this appeal. It must be resolved against Pfizer.[122]

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[119] Article 15 of the Convention on Biological Diversity addresses the terms and conditions for access to genetic resources and benefit-sharing. The CBD produced the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of Benefits Arising Out of their Utilization. See Secretariat of the Convention on Biological Diversity, Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of Benefits Arising Out of their Utilization (Montreal: Secretariat of the Convention on Biological Diversity, 2002), online: CBD <http://www.cbd.int/doc/publications/cbd-bonn-gdls-en.pdf>. See also, Chidi Oguamanam, "Canada: Time to Take Access and Benefit Sharing over Genetic Resources Seriously", (2010) 60 U.N.B.L.J. 139.

[120] *Apotex Inc. v. Wellcome Foundation Ltd*., 2002 SCC 77, at para.37.

[121] Vaver, *Intellectual Property Law*, *supra* note 25 in chapter 4, at 20.

[122] *Teva Canada Ltd. v. Pfizer Canada Inc*., 2012 SCC 60, at para. 80, available online: <http://scc.lexum.org/decisia-scc-csc/scc-csc/scc-csc/en/12679/1/document.do>.

S. 27 (3) of the *Canadian Patent Act* details what specifications of an invention a patent application must contain: "The specification of an invention must (a) correctly and fully describe the invention and its operation or use as contemplated by the inventor; (b) set out clearly the various steps in a process, or the method of constructing, making, compounding or using a machine, manufacture or composition of matter, in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it pertains, or with which it is mostly closely connected, to make, construct, compound or use it; (c) in the case of a machine, explain the principle of the machine and the best mode in which the inventor has contemplated the application of that principle; and (d) in the case of a process, explain the necessary sequence, if any, of the various steps, so as to distinguish the invention from other inventions."[123]

Patent disclosure has an educative function: it has to instruct the public and teach them the invention. A proper disclosure is one that contains "a full, clear and exact description of the nature of the invention and the manner in which it can be practiced."[124] Public disclosure should be an important function of the patent system, and patent authorities should strive to make the patent information more transparent and navigable for the public. Patent disclosure contributes to a public knowledge base upon which future innovation will build. The information contained in expired patents is a permanent part of a global innovation commons. Even when patents have not yet entered the public knowledge domain, the published patent information can be readily accessible from the online databases maintained by patent offices and productively used for the benefit of the society at large.

[123] *Patent Act*, R.S.C., 1985, c. P-4, s. 27(3).
[124] *Apotex Inc. v. Wellcome Foundation Ltd*., [2002] 4 S.C.R. 153, 2002 SCC 77 at paras 70.

6.4 WIPO's Role in Global Innovation Governance

Having explored ways to utilize TRIPS flexibilities in order to correct the imbalance in the TRIPS patent regime and integrate it into an optimal global innovation system, I will now turn to examine what recommendations can be made to other instruments and institutions. The foregoing discussions suggest that TRIPS does not cover all intellectual property subject matter, either because of lack of consensus at the time the Agreement was negotiated, or because the areas in question had not yet emerged. These areas include indigenous innovation and open innovation. Given TRIPS' limitations, we need to engage a growing array of institutional partners and stakeholders in a concerted effort to develop new norms in an innovation promotion regime that values equality and freedom and strikes a fairer balance between innovation and access. In particular, WIPO, I argue, can and should play a more important role in infusing human rights norms with intellectual property protection and promoting the dynamics of decentralized innovation production. WIPO might be a better forum to promote entrepreneurial spirit given its awareness and openness to a broader innovation agenda. WIPO has also undertaken pioneering work on the recognition and promotion of indigenous innovation through its Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore of WIPO (IGC).

This section considers the governance dimension of the global innovation system that coordinates, steers, and facilitates public and private initiatives to enhance countries' innovation capability and promote access to knowledge goods. The institutional and regulatory framework governing innovative actors and activities is a complex architecture of multilateral, plurilateral, and bilateral rules and standards that both hinder and promote

innovation capability. Through the engagement with the technological, legal, and social infrastructure for innovation, international institutions with regulatory capacity for innovative activities have a key role to play in building innovation networks beyond national boundaries.

It has been said that the WIPO's leadership in global intellectual property governance has been challenged by the establishment of the TRIPS Agreement and the fragmentation of international IP lawmaking authority and forum.[125] However, as Laurence Helfer notes, "the WTO did not supplant WIPO as the principal intergovernmental organization devoted to intellectual property lawmaking. TRIPs itself implicitly acknowledges the continuing importance of WIPO as a forum for negotiating treaties, particularly those embodying 'higher levels of protection of intellectual property rights.'"[126] In fact, as Joseph Stiglitz states, "we are unlikely to achieve a more balanced intellectual property regime in the framework of the WTO. At the very least, WIPO, whose mandate includes the promotion of the transfer of technology to developing countries and establishing an appropriate intellectual property regime, should be one forum in which these issues are discussed."[127]

I propose a WIPO Innovation Agenda to support countries with substantial social and economic divergences to cultivate local innovation capability and enhance social welfare through the development of innovation strategies and intellectual property policies. I argue

[125] For example, Christopher May describes the view that: "the establishment of the TRIPs agreement itself represented a significant challenge to the WIPO, perhaps most obviously as it removed sole responsibility for the international governance of intellectual property from the WIPO and firmly placed it with the WTO, while allowing some continuity of function for the WIPO." See Christopher May, *The World Intellectual Property Organization: Resurgence and the Development Agenda*, (London: Routledge, 2007) at 33. However, May contends that "despite the clear shift of its competencies and authority in the post-TRIPs period, it would be wrong to assume that the WIPO has been effectively marginalized or is no longer of any importance." *Ibid.*, at 35.

[126] Laurence R. Helfer, "Regime Shifting: The TRIPs Agreement and New Dynamics of International Intellectual Property Lawmaking," (2004) 29 Yale J. Int'l L. 1 at 25.

[127] *Supra* note 51 in chapter 4.

that the WIPO has demonstrated both the willingness and capability to direct a broader Innovation Agenda to complement its Development Agenda. The WIPO's significant role in intellectual property law-making and norm-setting, combined with its awareness of development objectives of intellectual property rights and openness to communitarian innovation and other emerging innovation models, make it a good candidate to promote a fair and balanced global innovation system. I will now outline four reasons to support my proposition.

First, the WIPO as a specialized UN agency has a mandate to cooperate with other UN organizations to promote human rights and achieve development objectives. According to Article 1 of the UN-WIPO Agreement, the WIPO has a special responsibility for capacity building in the developing world. It specifically recognizes that the WIPO is responsible for "facilitating the transfer of technology related to industrial property to developing countries in order to accelerate economic, social and cultural development."[128] In practice, the WIPO has taken the initiative to formulate innovative ways to employ intellectual property rights as a tool to solve a wide range of development problems (food, health, energy, etc.). It provides technical and legislative assistance and educational programs to Member States. It is also actively involved in assisting developing members in designing domestic intellectual property legislation, establishing administrative and juridical institutions, increasing public awareness of intellectual property, and training IP professionals. In addition, the WIPO is willing to contribute to an international intellectual property regime that promotes economic growth and inclusive and sustainable development. This is evidenced in Member States' consensus as expressed in the WIPO Development Agenda. The WIPO Development

[128] See *UN-WIPO Agreement*, done 17 December 1974, 956 UNTS 405.

Agenda demonstrates the unequivocal commitment of the WIPO Members to building a development-friendly international IP regime. For instance, the WIPO Development Agenda recommendation 10 states that Member States should be assisted

> to develop and improve national intellectual property institutional capacity through further development of infrastructure and other facilities, with a view to making national intellectual property institutions more efficient and promote fair balance between intellectual property protection and the public interest. This technical assistance should also be extended to sub-regional and regional organizations dealing with intellectual property.

Recommendation 22 states: "WIPO's norm-setting activities should be supportive of the development goals agreed within the United Nations system, including those contained in the Millennium Declaration."[129] Under recommendation 45 of the Development Agenda, the WIPO is to:

> approach intellectual property enforcement in the context of broader societal interests and especially development-oriented concerns, with a review that "the 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 obligations," in accordance with Article 7 of the TRIPS Agreement.

Second, the WIPO is a key forum for intellectual property treaty negotiation as well as soft law development. The WIPO Copyright Treaty (WCT)[130] and the WIPO Performances and Phonograms Treaty (WPPT)[131], which were both concluded in 1996, prove the success

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[129] WIPO Development Agenda, online: <http://www.wipo.int/ip-development/en/agenda/recommendations.html>.

[130] *WIPO Copyright Treaty*, 20 December 1996, 36 I.L.M.65 (entered into force 2 March 2002) online: WIPO <http://www.wipo.int/treaties/en/ip/wct/trtdocs_wo033.html> [WCT]

[131] *WIPO Performances and Phonograms Treaty*, 20 December 1996, 36 I.L.M. 76, online: WIPO <http://www.wipo.int/treaties/en/ip/wppt/trtdocs_wo034.html> [WPPT]

of the WIPO as a negotiation forum for intellectual property lawmaking.[132] Further, the WIPO has also led the development of soft law and has been actively involved in "more rapid, transparent, effective, and politically acceptable means of norm creation."[133] For example, the groundbreaking work on traditional knowledge and the launch of the WIPO Development Agenda affirm the importance of the WIPO as a pioneer in intellectual property norm-setting. Although soft law is not binding in nature, it is nonetheless followed by states in practice.[134] As Arpad Bogsch notes, soft law and norm-setting has always been one of the central tasks of the WIPO.[135] The WIPO has developed soft law through consultation, recommendation, guidelines, non-binding resolutions, and model laws,[136] as well as cooperation with other stakeholders in such emerging intellectual property issues as biotechnology patents and traditional knowledge protection. For instance, the WIPO has coordinated discussions in the field of genetic resources and biodiversity with other international institutions[137] and has pioneered innovative concepts for protecting traditional

[132] Peter Yu notes the WIPO Internet treaties have "successfully put the organization back to the forefront of the intellectual property law and policy debate." Peter K. Yu, "The Global Intellectual Property Order and Its Undetermined Future" (2009) 1 WIPO Journal, online: SSRN <http://ssrn.com/abstract=1485285> (last visited 31 December 2009).

[133] Edward Kwakwa, "Some Comments on Rulemaking at the World Intellectual Property Organization", (2002) 12 Duke J. Comp. & Int'l L. 179.

[134] *Ibid*., at 187.

[135] Arpad Bogsch noted that one of the central tasks of the WIPO "is the establishment of norms that oblige the Member States to grant a certain level of protection to the creators and owners of intellectual property, particularly where they are foreigners. … The norms require constant revision because the social, cultural, technical and economic conditions of mankind are constantly evolving and the institutions of our civilization—including the institution of intellectual property—must evolve with them to remain useful. It is the World Intellectual Property Organization that is responsible for keeping the institutions of intellectual property useful in such changing circumstances." See Arpad Bogsch, *The First Twenty-Five Years of the World Intellectual Property Organization from 1967 to 1992*, WIPO Publication No. 881(E), (Geneva: International Bureau of Intellectual Property, 1992).

[136] Paul Salmon, "Cooperation between the World Intellectual Property Organization (WIPO) and the World Trade Organization (WTO)", (2003) 17 St. John's J. Legal Comment. 429 at 431.

[137] See generally, UNEP-WIPO, "WIPO-UNEP Study on the Role of Intellectual Property Rights arising from the Use of Biological Resources and Associated Traditional Knowledge", (2005) WIPO Publication No 769 [E]. See also relevant multilateral agreements in the field of biodiversity, CBD, *supra* note 110 in chapter 4; the *Cartagena Protocol on Biosafety to the Convention on Biological Diversity*, done 29 January 2000, entered into force 11 September 2003, (2000) 39 ILM 1027; the *International Treaty on Plant Genetic Resources for Food*

knowledge.[138] In short, the WIPO is able to and should play a more important role in recognizing and promoting the dynamics of the global innovation paradigm by intellectual property law-making and norm-setting.

Third, the WIPO is willing to accommodate a broader innovation agenda through a paradigmatic shift from the narrow focus on intellectual property protection to intellectual resources management and effective innovation promotion. This paradigmatic shift is a healthy response to the costs and limits of intellectual property[139] and to the emergence of user and collaborative innovation.[140] The WIPO has taken steps to accommodate the emerging innovation paradigm by adopting the Development Agenda and providing an open forum for policy discourse and legal experimentation concerning the regulation and promotion of alternative innovation modes. The WIPO Development Agenda emphasizes the need to "facilitate access to knowledge and technology … and to foster creativity and innovation";[141] and to "exchange experiences on open collaborative projects such as the Human Genome Project as well as on intellectual property models."[142] In addition, these norms have started to be implemented in its daily operations. For instance, the WIPO

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and Agriculture, done 3 November 2001, entered into force 29 June 2004; and the UNESCO Declaration on Bioethics and Human Rights (19 October 2005) Records of the General Conference 33rd session vol 1, 74.

[138] See the WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore; the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (done 28 April 1977, entered into force 19 August 1980) 1861 UNTS 361.

[139] For instance, the Commission on Intellectual Property Rights proposes that the WIPO "should give explicit recognition to both the benefits and costs of IP protection and the corresponding need to adjust domestic regimes in developing countries to ensure that the costs do not outweigh the benefits." See CIPR, *Integrating Intellectual Property Rights and Development Policy*, *supra* note 86 in chapter 5, at 159.

[140] The United Nations Conference on Trade and Development (UNCTAD) recognizes that "ICT has also given rise to new models for sharing knowledge and collective production of ideas and innovations," known as "open access" models, "which often bypass the incentive system provided by [IP] rights." See UNCTAD, Information Economy Report 2007-2008, Science and Technology for Development: The New Paradigm of ICT (2007), online: <http://www.unctad.org/en/docs/sdteecb20071_en.pdf>, at 2. It also notes that "[a]n innovation policy framework that fully takes into consideration the changes generated by ICT must give prominence to open approaches to innovation, which present significant advantages for developing countries." *Ibid*., at 12.

[141] WIPO Development Agenda, Recommendation 19.

[142] WIPO Development Agenda, Recommendation 36.

Standing Committee on the Law of Patents, in its 12th session in June 2008, included sections on licensing, patent pools, collaborative research projects (including open source) and a discussion of potential problems caused by patent thickets. It also incorporated the issues of "alternative models for innovation", "limitations to the rights", and "research exemption" in its list of "issues for further elaboration and discussion."[143] At the July 2008 meeting of the WIPO Committee on Development and IP, the Electronic Frontier Foundation presented a statement in which it suggested that "WIPO could also provide Member States with information about the benefits for education and scientific research of Open Innovation and User Driven Innovation models" and that these "new theories of innovation … have the potential to radically reshape collaboration and innovation in the developing world."[144]

Fourth, the WIPO has the necessary technical expertise, governance structure, and financial and human resources to pursue a tale of two agendas—the Development Agenda and Innovation Agenda. As to the scope of engagement and technical expertise in intellectual property law and policy making, the WIPO has comparative advantage over the WTO and other relevant institutions in the international IP regime to set new intellectual property norms in order to keep pace with emerging technologies, administrating existing IP treaties, and collaborating with national IP authorities in technical assistance.[145] As to the

[143] WIPO, Standing Committee on the Law of Patents, "Report of the International Patent System", SCP/12/3, April 15, 2008, at 2-4; see also, Strandburg, "Evolving Innovation Paradigms and the Global IP Regime", at 910.
[144] EFF Statement at WIPO CDIP2 meeting, Second Session, July 7-11, 2008, cited in Strandburg, "Evolving Innovation Paradigms and the Global IP Regime", at 910.
[145] According to the agreement reached between WIPO and WTO, WIPO is responsible for administering international treaties and developing international laws and policies while WTO is mainly responsible for ensuring TRIPS compliance. See generally, *Agreement Between the World Intellectual Property Organization and World Trade Organization*, WIPO-WTO, 22 December 1995, 35 I.L.M. 754, available <http://www.wipo.int/export/sites/www/treaties/en/agreement/pdf/trtdocs_wo030.pdf>. Laurence Helfer

institutional capability and governance structure, the WIPO has a more flexible voting and governance structure than the WTO, which fosters ongoing engagement and more diverse input from stakeholders.[146] Graeme Dinwoodie and Rochelle Dreyfuss note that norm development through the adoption of soft law instruments and lawmaking processes at the WIPO "enable it to respond expeditiously to new issues … and successfully conclude[] negotiations over several new intellectual property instruments."[147] As to the financial and human resources, the WIPO is unique, compared with other UN agencies, in that it is by and large self-funded by the global filing system for patents and registration services for trademarks, industrial designs, and appellations of origin it offers.[148] The WIPO's 2008/09 budget reports that over 90% of the WIPO's funding comes from revenue paid by the private sector for the WIPO's registration and filing services, and Member States' contributions account for only 6% of its total revenue.[149]

To summarize, the WIPO can and should aim to become the World Innovation Promotion Organization and lead the development of a fair and balanced global innovation

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observes that TRIPS created "a bimodal intellectual property regime within which the two organizations [WTO and WIPO] shared authority according to their respective areas of expertise. Whereas the WTO emphasized implementation, enforcement, and dispute settlement, WIPO focused on generating new forms of intellectual property protection, administering existing intellectual property agreements, and providing technical assistance to developing countries." See *supra* note 3 in chapter 6 at 25. Similarly, Christopher May points out that WIPO focuses on "socialization and norm-building" and leaves enforcement to the WTO. See *supra* note 2 in chapter 6, at 35.

[146] Graeme B. Dinwoodie & Rochelle C. Dreyfuss, "Designing A Global Intellectual Property System Responsive to Change: The WTO, WIPO, and Beyond", (2009) 46 Hous. L. Rev. 1187 at 1193-1194.

[147] *Ibid*., at 1193-1194.

[148] WIPO, *WIPO Intellectual Property Handbook: Policy, Law and Use*, 2nd ed., (Geneva: WIPO, 2004) WIPO Publication No. 489(E), at 5, online: <http://www.wipo.int/export/sites/www/about-ip/en/iprm/pdf/ch1.pdf>.

[149] WIPO, *World Intellectual Property Organization: An Overview (2009 Edition)*, (Geneva, WIPO, 2009), online: <http://www.wipo.int/export/sites/www/freepublications/en/general/1007/wipo_pub_1007_2009.pdf> at 50. Michael Byers also notes that more than 85% of WIPO's income comes from services it provides. See Michael Byers, "The Challenge of Change", (2002) 12 Duke J. Comp. & Int'l L. 1 at 4.

system.[150] As Musungu and Dutfield suggest, the WIPO's mandate "should be constructed in the context of the development objectives of the specialized UN agencies as well as the broader objectives of achieving international co-operation in solving problems of an economic, social, cultural and humanitarian character, and in promoting and encouraging respect for human rights and fundamental freedoms."[151]

6.5 Incorporating TRIPS into a Fair and Balanced Global Innovation System

The economic dimension and individual right aspects of TRIPS have been overly emphasized to the detriment of other valuable perspectives. In addition to protecting private property and encouraging market expansion based on monopolistic control, TRIPS also aims to accomplish social goals and advance public interests. This section highlights equality and freedom norms and principles that ensure everyone's right to contribute to and benefit from an accessible innovation commons. Unlike the "trade utilitarianism" philosophy[152] and "individual ownership" and "exclusivity" norms that are center to the TRIPS patent regime, a fair and balanced global innovation system highlights the values of equality and freedom: equality of innovation capability and the freedom to innovate should be the constitutional principles and the normative foundation of a global innovation system.

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[150] Nandini Kotthapally, "From World Intellectual Property Organization (WIPO) to World Innovation Promotion Organization (WIPO)? Whither WIPO?" (2011) 3 W.I.P.O. J., Issue 1, at 56-70, available online: <http://www.wipo.int/export/sites/www/about-wipo/en/wipo_journal/pdf/wipo_journal_3_1.pdf>.

[151] Sisule F. Musungu & Graham Dutfield, "Multilateral Agreements and a TRIPS-Plus World: The World Intellectual Property Organization", TRIPs Issue Paper 3, (Geneva: Quaker United Nations Office, 2003) at 19, online: <http://www.quno.org/geneva/pdf/economic/Issues/Multilateral-Agreements-in-TRIPS-plus-English.pdf>.

[152] Long states: "Whether or not intellectual property laws may be justified under theories of natural law, labor, or personality, TRIPS establishes only one international philosophy for their protection—utilitarianism, or more precisely *trade* utilitarianism." (emphasis original) See Doris Estelle Long, "Democratizing Globalization: Practicing the Policies of Cultural Inclusion," 10 Cardozo J. Int'l & Comp. L. 217 at 243.

In a fair and balanced global innovation system, all innovators should be equal in dignity and entitled to recognition of their equal moral worth. They should have equal opportunity to obtain the basic innovation capability that enables them to function in the knowledge society. They should also have the right to participate on an equal basis in the decision-making process that affects their innovation capability and freedom. Any form of discrimination based on innovation model, status in the innovation life cycle and value chain, or association with a certain innovation community must be prohibited.

However, non-discrimination is not equivalent to identical treatment. The imbalanced TRIPS patent regime has favoured some innovators and disadvantaged others. Due to the special needs that disadvantaged innovators have, preferential treatment is needed to achieve equality in effect. In other words, substantive equality necessarily requires differential treatment of innovators according to their intellectual endowment and innovation capabilities. In addition, substantive equality also requires differential treatment of different technological fields according to their sensitivity to patent incentives. For example, the technologies that do not respond to patent incentives should be excluded from patent protection. By the same token, the technologies that are more sensitive to patent incentives should enjoy higher level of patent protection than those less sensitive technologies. Therefore, the recognition of substantive equality entails a positive obligation on the state to proactively implement comprehensive legislative, administrative, and policy measures with a view to accommodating disadvantaged innovators and under-incentivized technological fields.

The freedom to innovation has both negative and positive components. The negative freedom to innovate is the freedom that a person must possess in order to obtain the

minimum threshold of innovation capability. It means freedom from interference in acquiring and deploying one's innovation resources, exercising upon one's intellects, and exploiting values in the innovation market free from excessive patent rights and arbitrary regulations.

The positive freedom to innovate goes beyond the negative freedom and includes affirmative actions and positive rights that ensure one's real opportunity to access and use innovation resources in the commons and develop her full intellectual and innovation potential and extract values from it. One should have the right to decide whether to exploit her innovation capability individually or communally and whether to exploit it commercially through entrepreneurial initiatives or non-commercially by imparting the knowledge and enriching the public domain. Furthermore, the positive freedom to innovate should include the real opportunity to participate in law and policy making processes that affect one's rights and obligations under the innovation framework. In this sense, the freedom to innovate is not only the absence of interference to survive and operate in the knowledge society, but also the possession of a bundle of capabilities to thrive and prosper in it.

Innovation is necessary for much of the productivity, sense of accomplishment, and happiness that a person derives from life. The freedom to innovate is also essential for the functioning of populations. Without minimum core elements of freedom to innovate, people cannot fully engage in social interactions, participate in the political process, exercise rights of citizenship, generate wealth, create art, and provide for the common security. An intellectually vigorous population builds strong roots for a country's governmental structures, social organizations, cultural endowments, economic prosperity, and national defense. The freedom to innovate becomes a transcendent value because a certain level of

human functioning is a prerequisite for activities that are critical to the public's welfare—social, political, and economic.

Chapter Seven: Conclusion

The thesis aims to substantiate the idea that innovation is a capability that can be cultivated for equitable development and that a user's freedom to innovate should not be violated by excessive intellectual property rights. At the heart of this idea is the principle of substantive equality of innovation capability, which is comprised of five components: equality of innovation opportunity, neutrality of innovation models, accessibility of the innovation commons, dignity of the entrepreneurial spirit, and respect for indigenous innovation. These five components ensure that everyone has the basic innovation capability to function in the knowledge society and a real opportunity to access the innovation commons, mix her intellect with raw innovation resources, and participate in the decision-making process that affects her innovation capability and freedom.

By "equality" and "freedom," I do not intend to extend theories of justice and liberty in the western tradition of political philosophy to an international context.[153] My goal is to make a case for the substantive equality of innovation capability and the freedom to innovate in the making of international patent law and innovation policy. I argue that inequality of innovation capability is only unjust to the extent that it encroaches upon people's freedom to innovate. Put differently, inequality of innovation capability is justified if and only if there is no less innovation freedom-restricting arrangement.

Fundamental changes have shaped the global knowledge economy since the conclusion of the TRIPS Agreement. We live in an interconnected world with the continuous removal of barriers to communicate, trade, and collaborate with one another. The ubiquitous

[153] John Rawls and Ronald Dworkin have argued for egalitarian principles in a sovereign state. See e.g. *supra* note 30; and Ronald Dworkin, *Sovereign Virtue: The Theory and Practice of Equality*, (Cambridge, MA: Harvard University Press, 2000).

Internet has enabled pluralistic groups of innovators and revolutionized the way innovation is produced and disseminated. Some countries that were adamant advocates of stringent intellectual property rights during the TRIPS negotiation have experienced a relative decline of political power and economic and cultural influence in the world, such as the United States, while emerging economies have shifted the global trade flow.[154] In addition, diverse modes of segregating markets and organizing innovation production have prompted many multinational corporations that were based in developed countries to rearrange their intellectual assets and relocate their research centres across the globe.[155] With the emergence of open, collaborative, and user innovation models, there is a need for the coordination, facilitation, and steering of global efforts to promote the production and fair distribution of innovation.

This thesis envisions a fair and balanced global innovation system and proposes a two-pronged approach in order for the TRIPS patent regime to become an integral part of this system. To promote multidimensional and equitable development, an innovation capability approach to development aims to maximize the contribution of intellectual resources to economic growth and human development through cultivating innovation capability and harnessing the power of alternative modes of innovation. To stimulate innovation potentials, an innovation equality and freedom approach to the TRIPS patent regime aims to incorporate the TRIPS patent regime into a fair and balanced global

[154] According to World Intellectual Property Indicators 2012, China's State Intellectual Property Office (SIPO) overtook the United States Patent and Trademark Office (USPTO) in 2011 to become the largest patent office in the world. See WIPO, World Intellectual Property Indicators 2012, (Geneva: WIPO, 2012), online: <http://www.wipo.int/export/sites/www/freepublications/en/intproperty/941/wipo_pub_941_2012.pdf>; see also, WTO, International Trade Statistics 2012, (Geneva: WTO, 2012), online: <http://www.wto.org/english/res_e/statis_e/its2012_e/its2012_e.pdf>.

[155] Vivek Wadhwa, et al., "The Globalization of Innovation: Pharmaceuticals", (2008), available online: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1143472>.

innovation system, which increases the effectiveness of innovation systems and promotes democratic innovation governance.

This thesis has attempted to achieve four objectives. The first objective is to better understand the dynamics of innovation models and their overarching purposes with respect to national and international law. The thesis starts with a discussion of the definition of innovation, in chapter two, as a cumulative, collaborative, and systematic process to solve technological, commercial, and social problems. Innovation, as a cumulative process, is both an output of an innovation market and an input to generate future innovation. Even the most revolutionary innovations are based to some degree on prior knowledge. Therefore, it is important to cultivate and preserve a vibrant innovation commons that is equally accessible to all. Further, innovation is often the result of collaborative teamwork and has public good characteristics. Due to the network effects and positive externalities produced by innovation, collaboration and collegial information-sharing add value to existing innovation and provide more opportunities for future innovation. What is essential for innovation-based economic development in a networked knowledge society is the ability to establish linkages between the nodes (such as people, ideas, and technological standards) in the network. In addition, innovation is not necessarily a zero-sum game: more innovation in India does not have to stifle innovation in the United States. Human ingenuity is arguably a limitless resource that is available in every society. However, it is not uncommon that this resource is often neglected, suppressed, or under-valued in many parts of the world partially due to the defects in the current international intellectual property system. The key to exploit human ingenuity is to design effective innovation strategies that stimulate intellectual capital, make financial capital more accessible and risk-tolerant, coordinate intellectual property clusters, link key

occupants in the global innovation webs, and orchestrate value creation and multiplication. Finally, innovation should have normative commitments to social justice and equality: we should promote not only efficiency in the innovation market but also equality in the distribution of the benefits therefrom; not only economic prosperity but also innovation equality, environmental integrity, and human dignity.

A second goal of this thesis is to propose, in chapter three, an innovation capability approach to development and emphasize its underlying principles: substantive equality of innovation capability and freedom to innovate. I have applied the capability approach theory developed by Amartya Sen and Martha Nusshaum to critically analyze the role of innovation capability in development and how to ensure substantive equality of innovation capability and users' freedom to innovate for equitable development. Martha Nusshaum notes that the capability approach aims at making people able to function "in a fully human way."[156] As I understand it, the essence of being a human in a just society is to participate equally with others in learning knowledge, developing skills, and cultivating capabilities that are necessary for a dignified and functioning life and to freely express one's personality and develop one's potential through the perpetual pursuit of self-actualization, association with others, and interaction with the physical world. Therefore, the application of the capability approach in international patent law and innovation policy requires the cultivation and just distribution of the innovation capability and the real freedom to transform raw innovation resources to tangible and intangible values through mixing one's intellect with information in an innovation commons.

[156] Nussbaum, *Women and Human Development, supra* note 110 in chapter 3, at 71.

Chapter Three proposes an innovation capability approach to development, which aims to bring each human being to a basic level of innovation capability required to function in a knowledge society. The notion of innovation capability refers to a person's capacity to choose to associate with a community of innovators and to act upon her intellect in a way that is free from interference from proprietary control or arbitrary regulations. I argue that enhancing innovation capability and benefiting from the space created by the freedom to innovate are two important ways to equalize development gaps and promote distributive justice both intergenerationally and globally. This thesis makes the case that not only is innovation capability a strong competitive advantage in today's knowledge society, it also has a great potential to equalize the divide in people's capability to live a good life and pursue their life goals. Following an innovation capability approach, the rich and the poor can be more equal in exploiting their intellect, knowledge, and innovation capability.

Accordingly, national governments have a positive obligation to enable each and every citizen to have at least the basic innovation capability to act upon their intellect in order to function reasonably well in the knowledge economy. The basic innovation capability is a threshold of innovation capability below which the ability and autonomy to independently determine one's innovation activities, resources, and functionings in a society is unjustly restrained. In addition, national governments should make available equally to their citizens the opportunity to access and use innovation resources in the public domain. Moreover, they should ensure that innovators receive an adequate compensation that is fair to their investments while preserving their intellectual dignity and moral rights.

The equality of innovation *opportunity* is the preliminary criterion, but is not sufficient by itself, to achieve the goal of substantive equality of innovation *capability*. I

argue that there are four more conditions that must be met to ensure substantive equality of innovation capability: neutrality of innovation models, accessibility of the innovation commons, dignity of the entrepreneurial spirit, and respect for indigenous innovation. These five principles can not be properly implemented without the joint efforts of national governments and international institutions. With the economic globalization and information revolution, national governments, as the primary authoritative regulators within their jurisdictions, have diminished capacity to respond to challenges of a fundamental global nature. In other words, in an age of intertwined economies and interconnected human lives, neither the well-being of a society, nor the quality of life of its citizens is solely dependent on good governance at the national level.[157] Indeed, good governance in global innovative activities determines how effective national governments can exploit their innovation resources to produce optimal outcomes, partially by designing their intellectual property law and innovation policy. In addition, good governance is also very important to the fair distribution of innovation benefits.

A third goal of this thesis is to propose an innovation equality and freedom approach to the TRIPS patent regime. I have reviewed the evolution of international intellectual property law and showed that governments' legal flexibility and policy space to design its patent law and policy have been restricted with the gradual internationalization of the patent regime and its increasing linkage with the global trading system. TRIPS has fundamentally changed the global innovation regime and restrained national governments' ability to

[157] Saul H. Mendlovitz & Burns H. Weston, "The United Nations at Fifty: Toward Humane Global Governance" (1994) 4 Transnat'l L. & Comtemp. Probs. 309. The authors believe that "[w]e are moving...from 'geopolitics' to geogovernance,' from a highly competitive State-centric world order to one that is characterized by substantially increased cooperation and integration, and wherein the United Nations has, potentially, a central role to play." *Ibid*., at 311.

properly design their domestic patent regime in a way that promotes innovation capability and freedom. The TRIPS Agreement denies developing countries the legal flexibility and policy space that industrial countries used to build their technological and industrial bases throughout the formative stage of their industrialization. Successful development experiences indicate that the strength of patent protection and the level of technological and economic development are positively correlated. In addition, the TRIPS negotiating history signals the ultimate triumph of economic and political liberalism, while its salient features prove that over-protective patent protection may be suboptimal to provide innovation incentives and promote development. Additionally, economic concerns have taken predominance over societal values and public policy concerns, which has resulted in a denial of access to patented products and counter-productive anti-common effects.

I have also shown that TRIPS has inherent inefficiencies in enhancing innovation capability and promoting innovation freedom partially due to its theoretical basis of utilitarianism and mercantilism as well as its ignorance of Internet-enabled and government-supported innovation models. There has been mixed evidence on the impacts of the TRIPS patent regime on national innovation systems in countries of different development levels and technological expertise. It is fair to say that the TRIPS patent regime has so far benefited countries of higher innovation capabilities more so than those with lower innovation capabilities. Intellectual property rights do not always promote or necessarily impede innovation or development. Their complex relationships have been summarized as follows.

Thus, simple statements that IPRs always promote development through greater creativity, innovation, and technology transfer are incorrect without greater context. So are proclamations that IPRs harm poor countries via excessive rents paid to powerful foreign

companies, costly imitation, and limits on information access. Rather, IPRs are property conceived as components of national innovation strategies, with the complementary recognition that those rights are subject to regulatory restraint to achieve key objectives in public health, education, competition, and other policy areas.[158]

The inefficiency of the TRIPS patent regime in promoting innovation is partially due to its reliance on the patent as the sole mechanism to incentivize innovation, and partially due to the negative impact of the universal high patent standard on innovation systems. The focus of the TRIPS patent regime on stimulating innovation through patent protection alone is suboptimal. For one reason, the patent system is inherently suboptimal in innovation promotion because some individuals are priced out of access and thus innovations are not disseminated in a way that brings most benefits to society. Innovation induced by patent incentives may incur high social costs and only serve the needs of those who can afford over-competitive prices. More importantly, the patent system may also cause dynamic inefficiencies because existing knowledge is the most important input into the production of new knowledge. By limiting access to knowledge, it is fair to assume that the rate of innovation over the long term will be diminished.

The TRIPS patent regime is also suboptimal to promote innovation because patent rights are only part of the incentives to promote innovation. It is not necessary that patent incentives are effective to kindle new ideas and encourage innovation commercialization across different technological fields; nor is it true that countries with nominal innovation capability can respond to an increased level of patent protection. In fact, public support of

[158] Keith E. Maskus, *Private Rights and Public Problems: The Global Economics of Intellectual Property in the 21st Century*, (Washington, DC: Peterson Institute for International Economics, 2012) at 234.

basic research and communitarian collaboration in adapting foreign technologies to local conditions may prove to be more effective in countries with limited innovation resources and traditional societies. Further, non-proprietary innovation systems may be a more desirable choice over the patent system to incentivize innovation in certain circumstances. For example, local needs may be better served by indigenous innovation through incremental and communitarian innovation processes than patent-protected innovations. In particular, it is not wise to depend on patents alone to provide some essential products such as food and life-saving drugs. For these reasons, patents are best conceived as part of the innovation system aiming to create a conducive innovation environment and provide equal opportunity and a fair playing field for all.

In addition, the patent system, as it now stands, has inherent difficulties to strike a delicate balance between the interests of right holders and the public. The overall patent protection around the world has been increasing with the widening of protectable subject matter and the expansion of the duration, scope, and strength of the protection accorded. The expansion of patentable subject matters and the degrading of the utility standard in biotechnology inventions have enclosed a portion of scientific knowledge into the exclusive terrance of private right holders and denied the public access to a vibrant innovation commons. The application of patent protection has been extended to cover plants, animals, software, and business methods while the boundary between patented inventions and public knowledge is becoming blurred. Further, patent acquisition standards have relaxed, for example in the United States from "when in doubt, reject" to "when in doubt, grant."[159]

[159] Adam B. Jaffe & Joshua Lerner, *Innovation and its Discontents: How Our Broken Patent System is Endangering Innovation and Progress, and What to do about It* (Princeton, NJ: Princeton University Press, 2004) at 61.

There has also been a trend to reduce or eliminate limitations and exceptions to patent protection. Moreover, new rights have also been created: plant breeders' rights and rights to layout-designs of integrated circuits are two such examples. Finally, the overlapping and fragmentation of patent rights (e.g., patent thickets) has made it very difficult to precisely define what the invention is and to delineate the boundaries of the exclusive rights. Innovation is impeded as a result of the threat of patent disputes and increased enforcement costs. In short, the patent system has inherent problems such as proliferation of trivial patents, unclear boundaries of patent rights, and fragmentation of patent rights that make it inefficient to promote innovation. Therefore, an effectively functioning innovation system ought to be one that combines the patent system and non-proprietary innovation systems (e.g., prizes, government support, and open and collaborative innovation) to a desirable ratio.

In addition to the inefficiencies that the TRIPS patent regime has in promoting innovation, it has also raised questions of justice and equality in the distribution of innovation benefits, particularly in relation to access to medicine, genetic resources, and sustainable development. I suggest an innovation equality and freedom approach to guide the implementation and interpretation of the TRIPS patent regime.

Patent rights are a creature of positive statute and have been justified as a utilitarian instrument to maximize wealth.[160] The utilitarian approach to the patent system must be complemented by social justice considerations, such as equality of development resources and innovation opportunity. I argue that the dominant instrumentalist justifications discount

[160] "The overall assessment of intellectual property's instrumental goal—the promotion of 'progress,' at least in the U.S. context—has been dominated of late by the assumption that pure wealth or utility-maximization serves adequately to evaluate social welfare." See Margaret Chon, "Intellectual Property and the Development Divide," *supra* note 25 at 2831.

the normative values of freedom and commitment to addressing the inequalities resulting from the unfair distribution of innovation opportunities. I argue for a substantive conception of equality and freedom that requires not only the elimination of formal discrimination but also efforts to ameliorate social factors that limit innovation opportunities. Over-propertization of the intellectual property regime and the lack of bargaining power in international negotiations can have profound negative ramifications for people's ability to freely pursue their life goals. Thus, governments should have an obligation to provide the prerequisites of innovation, including an innovation commons, so that everyone has a fair opportunity to gain a threshold of innovation capability and to participate as full and active members of the knowledge society.

The innovation equality and freedom approach to the TRIPS patent regime depends on both market mechanisms and government policies to provide the financial investment, institutional support, and entrepreneurial incentives that are important to create an environment that is conducive to innovation. In particular, governments should orchestrate the establishment of knowledge clusters and innovation networks that connect dispersed innovators (such as universities, government-funded research labs, and corporations).[161] The innovation equality and freedom approach to the TRIPS patent regime helps to advance distributive justice and intergenerational equality objectives. Distributive justice requires that everyone should have an equal opportunity to acquire the basic innovation capability and intergenerational equality requires that future generations have equal innovation opportunities for acquiring no less innovation capability than their predecessors. It is

[161] Daniel Gervais, "Of Clusters and Assumptions: Innovation as Part of a Full TRIPS Implementation," (2009) 77 Fordham Law Review 2353 at 2363.

precisely due to the distributive implications of global innovation commons that global actions are urgently needed to equalize innovation opportunities for all innovators.

A fourth objective of this thesis is to incorporate the TRIPS patent regime into a fair and balanced global innovation system to overcome the main problems that have caused the underperformance of the TRIPS patent regime in enhancing innovation capability and safeguarding the freedom to innovate. Under the current TRIPS patent regime, more capable innovators (e.g., large companies) with a great deal of innovation resources are better equipped to work within the current patent system thus making it more difficult for less capable innovators (e.g., smaller enterprises) to compete. To construct a fair global innovation system, it is necessary to provide equal innovation opportunity for everyone to freely access an enabling innovation commons and equally participate in decision-making that affects her innovation capability and freedom. A principle of equality of opportunity aims to remove the barriers to innovation that disadvantaged innovators face as well as to create a fair playing field so that everyone has a better opportunity to become functioning members of the knowledge society. In addition, special measures should be implemented to accommodate the needs of innovators of lesser innovation capability and indigenous innovators. To construct a balanced global innovation system, it is necessary to safeguard users' freedom to innovate which has both negative and positive dimensions. The negative dimension of the freedom to innovate prevents the interference of the flow of information and foundational innovation resources. The positive dimension of the freedom to innovate affirms everyone's right to allocate innovation resources and the liberty to choose the compensation method. In short, a fair and balanced global innovation system ensures that all innovators can compete fairly in the innovation market.

A fair and balanced global innovation system has legal implications for both national governments and international institutions. A national government has the obligation to bring each and every citizen to a point of fair competition in the innovation market. This means the government should provide equal opportunity to every citizen to freely access the innovation commons and equally participate in the decision-making process that affects her innovation capability and freedom. In addition, an optimal system of innovation ought to be based on a complementary combination of proprietary and non-proprietary systems in order to produce the highest attainable rates of innovation, productivity, and social utility. For international institutions, I have suggested that the WIPO may be a more appropriate forum for the governance of a fair and balanced global innovation system. There seems to be an apparent incompatability between international trade and intellectual property rules.[162] The WTO aims to eliminate trade barriers and promote free and fair trade, whereas by definition intellectual property restricts the freedom of commerce and trade.[163] Moreover, since the specifications and inducements of innovation models vary dramatically depending on different social and economic settings, the TRIPS patent provisions should be interpreted and implemented in such a way that national innovation regulators have the policy space to implement development measures that accommodate the diversity and dynamism of innovation models. I have proposed ways to implement and interpret TRIPS to make it more innovation-friendly by (1) restricting the scope of patentable subject matter; (2) limiting the

[162] Jagdish Bhagwati posits that intellectual property should never have been included in multilateral trade agreements. Jagdish Bhagwati, "Afterword: The Question of Linkage," (2002) 96:1 American Journal of International Law 126.

[163] Joseph Stiglitz notes: "Unlike traditional trade liberalizations, where tariff reductions benefit both parties, the exporter and the importer, intellectual property rights represent a transfer; the holder of the intellectual property right is better off, and the user is worse off." *Supra* note 51 in chapter 4.

scope of patent rights in the acquisition phase; and (3) imposing exceptions and limitations to patent rights when patents are in force.

I hope this thesis can achieve the above four objectives and contribute to the existing literature along three different dimensions. The thesis provides a comprehensive examination of the international regime for innovation and development. Moreover, it brings three often isolated areas of literature together under the same tenet: international trade and intellectual property law with special attention to the development dimension; innovation studies; and global governance informed by a cosmopolitan justice perspective. What distinguishes this thesis from the general TRIPS legal scholarship is twofold. First, the interdisciplinary approach broadens both the scope of research and the perspectives of analysis. TRIPS is undoubtedly the most important and most comprehensive instrument of global IP governance. However, this thesis also draws from theoretical and empirical resources as well as historical and comparative insights in science and technology policy, innovation studies, international relations and development policy. Second, a new conceptual and normative framework emerges from the interdisciplinary approach. It is the humble hope of the author that this thesis help motivate and contribute to an equitable patent law discourse that will give policy meaning to innovation and development.

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