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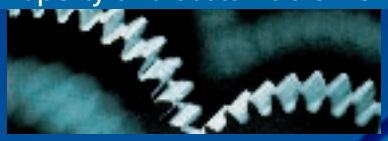


Access to Climate Change Technology by Developing Countries

A Practical Strategy

By Cynthia Cannady
IP*SEVA

ICTSD Global Platform on Climate Change, Trade Policies and Sustainable Energy

ICTSD
International Centre for Trade and Sustainable Development

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ICTSD welcomes feedback and comments on this document. These can be sent to directly to the author at cannady@ipseva.com or to aabdellatif@ictsd.ch.

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CONTENTS

LIST OF BOXES iv

LIST OF ABBREVIATIONS AND ACRONYMS v

FOREWORD vi

EXECUTIVE SUMMARY viii

1. DEFINING THE PROBLEM – BARRIERS TO DEVELOPING COUNTRY ACCESS TO CLIMATE CHANGE TECHNOLOGY? 1

2. CRITICAL ANALYSIS OF SOME APPROACHES TO THE PROBLEM OF DEVELOPING COUNTRY ACCESS TO CLIMATE CHANGE TECHNOLOGY 4

2.1 Compulsory Licensing 4

2.2 Patent Information/Databases 5

2.3 Patent Pools and Commons 6

2.4 Structured Licensing Mechanisms 12

3. WHAT CAN WORK: A TWO-PRONGED APPROACH 15

3.1 Climate Change Technology Innovation Strategy 15

3.2 Technology Collaboration Based on "Win-Win" Contracts 17

4. RECOMMENDED ACTIONS FOR ACCESS TO CLIMATE CHANGE TECHNOLOGY 21

5. UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE DRAFT RECOMMENDATIONS FOR "ENHANCED ACTION ON TECHNOLOGY TRANSFER" 24

6. CONCLUSION 26

ENDNOTES 27

REFERENCES 31

LIST OF BOXES

Box 1 Innovation strategies in China and Cuba 15
Box 2 Win–win technology contracts 18
Box 3 One-sided technology contracts 18
Box 4 Green technology packages 19

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired immunodeficiency syndrome
ARIPO	African Regional Intellectual Property Organization
BRICS	Brazil, Russia, India, China and South Africa
CCTIS	Climate change technology innovation strategy
DRM	digital rights management
EPC	European Patent Convention
EPO	European Patent Office
EU	European Union
FRAND	fair and reasonable non-discriminatory royalties
FTA	free trade agreement
GNP	gross national product
3GPP	3rd Generation Partnership Project
IEEE	Institute of Electrical and Electronics Engineers
IP	Intellectual property
IPCC	Intergovernmental Panel on Climate Change
IPRs	Intellectual property rights
IT	information technology
LDCs	Least developed countries
LTE	Long Term Evolution
MPEG	Moving Pictures Expert Group
OAPI	Organisation Africaine de la Propriété Intellectuelle
OPA	Open Patent Alliance
PCT	Patent Cooperation Treaty
PIPRA	Public Intellectual Property Resource for Agriculture
RAND	Reasonable non-discriminatory royalties
R&D	Research and development
SME	Small and medium-sized enterprise
TRIPS	Trade-Related Aspects of Intellectual Property Rights
TTM	Technology transfer mechanism
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
USC	United States Code
USPTO	United States Patent and Trademark Office
WBCSD	World Business Council for Sustainable Development
WIPO	World Intellectual Property Organization

FOREWORD

Access to climate change technology, in particular by developing countries, is a key element of any effective international response to the global climate change challenge and one of the pillars of the United Nations Framework Convention on Climate Change (UNFCCC). In this regard, the Bali Plan of Action called for "enhanced action on technology development and transfer".

Since the Bali meeting, the role of intellectual property rights (IPRs) has been the subject of increased attention in climate change discussions on technology transfer. Different views and positions have emerged concerning how intellectual property (IP) functions to facilitate or hinder access to climate change technology. The UNFCCC negotiating texts[1] contain a wide spectrum of options and proposals relating to IP, which reflects this diversity of views.

In this context, this new ICTSD paper aims to contribute to these discussions by providing a much needed practical perspective on how these options and proposals would work "in the real world" and the extent to which they would effectively enable developing countries to gain greater access to climate change technologies.

The author, Cynthia Cannady, is founder of IP*SEVA, a law firm specializing in representation of sustainable energy technology ventures, and has extensive experience in technology licensing in addition to international policy work, as former director of the Intellectual Property and New Technologies Division at the World Intellectual Property Organization (WIPO).

The paper critically examines various approaches that have been suggested for achieving greater access to climate change technology by developing countries, including compulsory licensing, patent pools, patent databases and structured voluntary licensing "mechanisms". The author details the practical problems facing these approaches to achieve the expected results for developing countries.

Instead, the author argues for a practical two-pronged strategy. The first prong is climate change technology innovation strategy (CCTIS), focusing on supporting climate change research and innovation *in developing countries by developing country scientists*. The second prong of the strategy is "win-win" development collaboration agreements for climate change technology between developed and developing country parties. Cannady's approach emphasizes that the first prong – innovation strategy – is the foundation that makes the second prong – mutually beneficial technological collaboration – possible.

Finally, the paper reflects on the UNFCCC draft recommendations for "Enhanced Action on Technology Transfer". It emphasizes the fact that important recommendations on funding, incentives and development collaboration need to be detailed and made concrete. The author urges negotiators to recognize the need to support developing country universities and research institutions in any future agreement.

The points made in the paper are likely to be thought-provoking for both those, who believe, in the author's words, that "the notion that enforcement of IP laws per se promotes innovation (the favoured myth of developed countries), or that technology transfer can occur in a one-way flow of assets (the favoured myth of developing countries)".

More generally, the paper is an invitation to think critically about the issues raised in climate change discussions on technology transfer and IP and to consider the concrete implications of some of the proposals that are advanced in these discussions.

One point that clearly emerges from these debates is the need for further evidence-based analysis to inform policy-makers and negotiators.

For this purpose, and building on previous research in this area, the International Centre for Trade and Sustainable Development (ICTSD), the European Patent Office (EPO) and the United Nations Environment Programme (UNEP) are undertaking a joint project to examine the role of patents and technology licensing in the development and transfer of climate change technologies, in particular in the field of energy generation. This initiative is expected to provide input into ongoing discussions on technology transfer in the near future.

This paper was commissioned under the ICTSD Programme on IPRs and Sustainable Development as part of ICTSD's Global Platform on Climate Change, Trade and Sustainable Energy, which is aimed specifically at contributing to effective international cooperation towards addressing climate change, by advancing analytical capacity of stakeholders and their interaction with policy-makers such that effective solutions can be built and agreed by the international community at the Copenhagen COP-15, in December 2009.

ICTSD's Programme on IPRs and Sustainable Development has sought to achieve a better understanding of IP in the context of sustainable development with a view to ensuring proper balance between the different interests at stake in designing appropriate IP regimes supportive of development objectives and compliant with international commitments. Another central objective has been to facilitate the emergence of a critical mass of well-informed stakeholders in developing countries – including decision-makers and negotiators, but also actors in the private sector and civil society – able to define their own sustainable human development objectives in the field of IP and effectively advance them at the national and international levels.

The premise of ICTSD's work is based on the understanding that IPRs have never been more economically and politically important – or controversial – than they are today. Patents, copyrights, trademarks and geographical indications are frequently mentioned in discussions on such diverse topics as public health, climate change, food security, education, trade, industrial policy, traditional knowledge, biodiversity, biotechnology, the Internet and creative industries. In a knowledge-based economy, a better understanding of IP is indispensable to informed policy-making in all areas of development.

In this context, we hope that you will find this issue paper a useful contribution to ongoing discussions about the transfer of climate change technologies, with a view toward achieving their wide and affordable diffusion, particularly to developing countries. We also hope that it will be a valuable input for government negotiators, as well as other stakeholders, to reflect upon and consider in formulating their positions and views, at the UNFCCC, in relation to these important issues.

Ricardo Meléndez-Ortiz
Chief Executive

EXECUTIVE SUMMARY

Climate change presents a momentous challenge for developing countries.[2] Water scarcity in arid regions, island inundation, bacterial contamination and immunity deficit, food shortages, expensive energy and infrastructure collapse due to energy shortages are all foreseeable crises with catastrophic consequences for poor people. Developing countries need to employ climate change technologies in order to avert climate catastrophe.

This paper critically examines various approaches that have been suggested for facilitating access to climate change technology by developing countries, including compulsory licensing, patent pools, patent databases and structured voluntary licensing "mechanisms". These are non-solutions, or at best partial solutions, because they would not deliver adequate results. Most of these approaches are based on an outmoded model of patronizing relationships between technology owners (developed country parties) and passive recipients of technology transfer (developing country parties).

In this regard, some of the suggested approaches could potentially be detrimental to developing countries. For example, in some cases patent pools may cover patents not legally valid in many developing countries, while requiring developing countries to contribute their own intellectual capital and/or pay royalties for the use of patents that they otherwise would not be legally required to pay. Patent information databases are compilations of public material that is already accessible to developing countries, while diverting funding opportunities to lucrative information technology (IT) contracts (to change the search parameters or organization of the data) to developed nation enterprises and experts. Proposals for structured voluntary licensing mechanisms entail royalties, and they place too much reliance on management by developed country professionals, international bureaucratic arrangements (of what must be an agile business process), expensive software, and packaged technology portfolios selected by developed country parties. Most damaging, non-solutions divert finite resources from effective solutions.

This paper proposes a two-pronged strategy for developing countries to gain access to climate change technology, while forging a pathway for national and regional development. The first prong is a climate change technology innovation strategy (CCTIS). Developing countries should target climate change research in their universities and research institutions, strengthen innovation infrastructure to support their researchers, claim the economic value of their human capital as intellectual property (IP), and participate as owners in the growing global market for climate change technology. An innovation strategy should target the funding and infrastructure deficit that cripples research, development and commercialization *by developing country actors in developing countries*. International funding initiatives should support developing country-originated CCTIS.

CCTIS is the foundation for the second prong of this approach: mutually beneficial technology transfer[3] contracts. Such contracts, generally technology licences and development collaboration agreements, should be "win–win" contracts, balanced in benefit to both parties. Without the support of a realized innovation strategy, attempting to negotiate beneficial technology transfer agreements is like constructing a building without a foundation.

Climate change technology development will benefit developing nations directly by providing useful technologies, and bargaining power in negotiation of licensing and collaboration agreements, but also indirectly by providing jobs and other spillover effects. Regional research and development (R&D) networks will extend opportunities to least developed countries (LDCs). This paper describes precedents for this strategy in China and Cuba.

CCTIS is not an excuse for developed countries to place responsibility solely on developing countries for solving their own economic and climate change problems. Developed country actors must also be willing to commit to change, opening towards open innovation with developing country partners. One reason why open innovation in new markets is attractive today is the scarcity that has hit the developed world with the global economic crisis, concomitant with the gradual realization that traditional sources of financing may have shifted. Another is the critical need for markets for climate change technologies in order to achieve the traction that new technologies need to pull through to mature commercialization. Developing countries are potential markets with additional customers that developed countries need in order for their green industries to survive and grow. Further, technology is not a zero sum game: the larger the green platform, the more space there is for many players.

Consensus can be achieved on this practical strategy for several reasons. It respects the logic of the IP system: that human capital is valuable and creates technical solutions to human needs as well as economic effects. It is hard to argue with the premise – once it is squarely posed – that developing countries should participate in the IP system as owners and traders in technology.

This is a medium- to long-term strategy that is likely to work. The tendency to insist on immediate technology transfer by shallow devices and ineffective measures has proven illusory in the past.[4] This does not mean that project-oriented approaches for prompt results should not be attempted (e.g. a solar photovoltaic field installed in a developing country), but rather that such initiatives should be implemented as part of a longer-term strategy (e.g. the solar facility agreement includes explicit terms to engage the local university).

This paper makes five recommendations, with specific sub-proposals, for how this strategy can be implemented, including initiatives appropriate for the Copenhagen agenda: support for endogenous climate change research and development; management of development country intellectual assets; climate change technology commercialization; awareness programmes; and periodic assessment.

Finally, this paper urges that international climate change discussions leading to Copenhagen and beyond present an opportunity to link climate change technology transfer with development of national innovation systems in order to achieve concrete results for developing countries. Theoretical and legalistic discussion concerning IP and technology in developing countries, without action and application, does not yield concrete results. Mythologies that have failed should not be repeated, such as the notion that enforcement of IP laws per se promotes innovation (the favoured myth of developed countries), or that "technology transfer" can occur in a one-way flow (the favoured myth of developing countries).

To date, the developing country scientist is the "invisible man"[5] in the big picture of the pre-Copenhagen negotiations. Scant attention has been paid to climate change technology R&D in developing countries. Copenhagen must recognize this "invisible man" and invite him to the negotiation table.

Urgent action to implement CCTIS is critical because the human capital of developing countries is the sine qua non for their access to climate change technology. Furthermore, only full engagement of all human beings in the search for climate change solutions will make our collective survival feasible.

1. DEFINING THE PROBLEM – BARRIERS TO DEVE–LOPING COUNTRY ACCESS TO CLIMATE CHANGE TECHNOLOGY

Developing countries have pointed increasingly, since the 2007 United Nations Framework Convention on Climate Change (UNFCCC) Bali meeting, to the "role" of intellectual property rights (IPRs) as a possible barrier in the transfer of climate change technologies. To a great extent this use of the word "role" is a misnomer: intellectual property (IP) is the legal mechanism by which technology is transferred through licensing and assignment agreements.

In order to assess the problem of barriers to technology transfer, it is important to work with a common definition of technology transfer. Critical to the concept of technology transfer is empowerment of the developing country party to the contract. Therefore, this paper assumes a definition of technology transfer that excludes transfers from a developed country company to its controlled subsidiary, location of manufacturing facilities/sales offices, sales of technology-based goods, and other situations where the developing country parties' role is essentially passive. By "technology transfer" and "access", we mean only situations where developing country parties are enabled to use and evolve technology in their own institutions and businesses, because they receive an IP licence and/or a binding contract for collaborative development, training, documentation and know-how.

The doctrines of substantive IP law are not currently a barrier to climate change technology transfer to developing countries because legal doctrines do not discriminate against developing country inventors and creators.[6] On their face, IP doctrines are neutral.

The problem is practical, not theoretical. Most developing countries do not have bargaining power to negotiate for licences to climate change technology because they have neither capital to buy/licence the technology, nor large wealthy markets, nor IP ownership of climate change technology that can be bartered. The last of these factors can be changed by a strategy that mobilizes intellectual capital that already exists in developing countries.

By and large, developing country research institutions do not patent based on their own research results, in their own countries or in foreign jurisdictions.[7] In many cases, their research results are merged with research from their sponsors, on whom they are dependent for funding because of express prohibitions on patenting in grant documents and/or because of inadequate budgetary support for tertiary education and scientific research. Many developing country university professors and graduate students are on a research-starvation diet, wondering where their next grant nourishment will come from. It is a tribute to their resourcefulness and sheer intelligence that, despite these conditions, many developing country university researchers have carried out high-quality research initiatives in solar, water, biofuels and other climate change technologies.

In some emerging economies that have invested in research, such as Brazil, Mexico and India, patents have not, for a long time, been perceived as an important component of the research culture, and so patenting is low, even though research quality and publication levels are high.[8] Although this may be changing, the result has been low patenting and an "IP divide".[9] Low patenting does not mean low research, but the effect of low patenting is that it is difficult to create economic value from intellectual capital.[10] It also means that non-owner nations and their citizens may be at risk for royalty demands by IP owners when they use, develop and commercialize technologies.

Today, it appears that climate change technology is not yet as heavily patented as biotechnology, agriculture and information

technology.[11] Although further evidence-based research is needed to corroborate this, for the moment this appears to be correct for several reasons.

First, venture capital investment in the United States of America (USA) has weakened at the same time that climate change awareness has grown. The funds that were prodigiously available to fund technology start-ups and pay lawyers for information technology (IT) and biotechnology patent management are now constrained. Some small and medium-sized enterprise (SME) inventors draft their own patent claims or use the US provisional patent application in a misguided effort to save money and avoid legal fees. The financial constraint on patent filing is less in some European countries and Japan, where there has been formal governmental innovation strategy and coordinated industrial policy in favour of climate change technology.

Second, developers of solar, wind, biomass and other energy and environmental technologies have not generally protected their inventions in developing countries. For instance, the decision not to patent in sub-Saharan African nations through the two regional IP protection systems, African Regional Intellectual Property Organization (ARIPO) and Organisation Africaine de la Propriété Intellectuelle (OAPI), may be because of a lack of familiarity with these processes, as well as because of a decision by inventors that they will not make, use or sell climate change technology products in African markets.

International business lobbies fight fiercely for one-stop patent shopping in the form of a global patent system administered by the World Intellectual Property Organization (WIPO), in Geneva, precisely because it would make it easier to get coverage in all countries without their administrative review (search and examination to see whether the invention is really new and otherwise meets the national criteria for patenting) and consent.[12]

European patent protection is also expensive, in terms of filing fees, search costs, translation costs and legal fees.[13] For many US SMEs with energy and environmental technologies, protection in Europe is prohibitively expensive and the perception is that the US market is sufficiently profitable. Some companies patent in emerging economies, such as Brazil, Russia, India, China and South Africa (BRICS), but for most developed nation companies the markets in these countries are considered peripheral and do not justify the legal cost of filing applications in each nation or even of filing an application with the WIPO Patent Cooperation Treaty (PCT) facility.

The practical effect of failure to patent in particular geographical markets is that the inventions are in the public domain as long as products using the invention are not exported back into a country where the patent has been applied for and issued.

Third, much of climate change technology is mature technology. The best example of this is solar technology. China has moved into this area quickly and effectively, becoming the world's largest developer, manufacturer and exporter of solar cells. This was possible partially because the technology used was several generations old. It stands in contrast, for instance, with the hard-fought entry of Japanese companies such as Hitachi and Fujitsu in the 1980s into a semi-conductor market where patent concentration was already achieved by US companies IBM, Texas Instruments and others. One of the most interesting uses of solar technology that I have witnessed was in 2003 at the Science Research Park in Harare, Zimbabwe, where students had installed solar-powered streetlights on the avenue in front of the main entrance, using their own industry and non-novel technology.

Thus, there is a window of opportunity in which patents in climate change technology are not heavily concentrated and where developing countries can stake out territories on the green patent map. There is a need

to concentrate on what will work to make developing countries owners and traders in climate change technology. We must also analyse candidly what approaches seem likely to not work or at least to entail significant costs and inefficiencies.

2. CRITICAL ANALYSIS OF SOME APPROACHES TO HE PROBLEM OF DEVELOPING COUNTRY ACCESS TO CLIMATE CHANGE TECHNOLOGY

As scholars and analysts study the problematic junction of climate change technology, IP law and economic development, various approaches have been proposed for enhancing developing country access to climate change technology. Climate change affords a new opportunity to reheat a discussion that was already simmering with respect to access to medicines.[14] Unfortunately, some of the discussion seems focused on partial solutions, non-solutions, generalities or rhetoric.

2.1 Compulsory Licensing

Much of the debate over public health, access to drugs for acquired immunodeficiency syndrome (AIDS) and patents has focused on compulsory patent licensing. Compulsory licensing is well established in law and practice in developed nations. It is justified as a public necessity in cases where private technology owners do not make needed technology available for the public good. Compulsory licensing is to IP law what eminent domain is to real property law: it is generally acknowledged as an essential legal doctrine, but no one wants to be the subject of its exercise.

Compulsory licensing is recognized as legal in Article 31 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), although the agreement does not use the words "compulsory licensing". The intense discussions in Doha yielded a statement of what was evident from the language of Article 31 – that compulsory licensing is legal.[15] Under TRIPS a national health emergency is not a prerequisite to exercise of compulsory licensing, and a country may invoke compulsory licensing for climate change technologies without violating TRIPS. However, TRIPS Plus provisions in free trade agreements (FTAs), such as the FTA between the USA and Jordan, have imposed additional "emergency" and "urgency" conditions for the exercise of compulsory licensing.[16]

Compulsory licensing is exercised, with apparent legitimacy, by developed countries. For example, in 2001, Canada dealt with a perceived need for ciprofloxacin to combat an anticipated outbreak of anthrax by exercising compulsory licensing of Bayer's patented drug Cipro™.[17] Canadian law permits compulsory licensing in the event of "abuse of rights", which is liberally defined as "demand in Canada not being met".[18] In the US, courts have authority to impose a royalty-bearing compulsory license, as an alternative to an injunction against further infringement, on an infringer and patent owner.[19] Also, various federal statutes, such as the Clean Air Act[20], confer authority for a court, at the government's request, to order a compulsory license with the royalties decided by the court. Brazil, South Africa, Indonesia and Thailand are among the developing countries that have recently invoked compulsory licensing; each time the legitimacy of their actions was questioned by some developed countries.[21] Despite the theoretical availability of compulsory licensing, its use by developing countries is relatively rare because of the potential political repercussions.

Compulsory licensing is an important safety valve option for situations of public need where, despite attempts to negotiate a voluntary licence, agreement on royalties cannot be reached. However, it is not a realistic way for developing countries to gain access to climate change technology, because it is too confrontational, complex and lengthy to use in the ordinary course of business.

Even if compulsory licensing could be used in the ordinary course of business, it does not function to create the science and technology infrastructure needed to use, evolve, improve and commercialize technology. Voluntary licensing of patents requires, as a practical matter, a consensual business relationship in which more than abstract rights to use patents are exchanged. That is why most technology contracts are in the form not of pure patent

licences but rather of development collaboration or strategic joint venture contracts in which IP licences are but one element.

Finally, centring the climate change debate on compulsory licensing would be of limited practical utility because, as noted above, climate change technology patents are often not filed in developing countries. For all of the above reasons, it would be unfortunate to use international climate change negotiation as a way to gain acceptance of a legal procedure that is already available in theory but difficult to exercise in practice.

2.2 Patent Information/Databases

Patent information databases have been proposed as a quasi-technology transfer to provide access to climate change technology.[22] Patent information consists of the text of granted patents and published patent applications, including the abstract, specification, drawings and all-important claims. WIPO has been particularly active in advocacy of patent information as a special tool for developing countries to use IP since 1975 when it started the WIPO Patent Information Service, which engaged in the then useful task of printing hard copies of patents and sending them in the mail to developing country requesters.[23] The Internet and increasing patent sophistication have led to a new iteration of patent services in the form of PatentScope, a WIPO database that aggregates PCT patent data from developed and developing countries.[24]

WIPO's frequently stated position is that patent information offers a "goldmine" of technology guidance to developing countries and that improvements based on nuggets extracted from this goldmine can be used and commercialized to good effect. There are some anecdotes to support the goldmine claim, but to a large extent it is as founded as claims of gold in the hills usually are.

Patent information from large patent jurisdictions is arranged and published by governments and private parties and can be searched for free, using keyword searches and numerical classifications by any person with access to a computer and the Internet. An example of a public database is the European Union's (EU) EspaceNet website, which includes free access to the full text of patents and patent applications from all over the world.[25] The United States Patent and Trademark Office (USPTO) website also offers full text patent searching, which is free to anyone and easy to use.[26] Private companies also publish and charge for access to patent databases with some added-value features that are generally necessary only for law firms conducting litigation searches or for patent examiners.

Patent databases can be searched to learn details about climate change technology patents. The full text is generally available. However, search and study of the text of patents does not amount to technology transfer, for several reasons. Reading the claims of an invention relating to a wind turbine or to carbon nanotubes for water filtration does not grant a legal right to use the technology. If the patent was not filed in the country where the reader plans to make, use or sell the technology, then the reader is free to imitate (copy) and use the invention, as long as another patent does not interfere. However, if the patent was issued in the reader's country, then the reader is forbidden from using the invention for a period of approximately 20 years. Making an improvement that builds upon the issued patent does not necessarily insulate the diligent user of patent information from liability, as he or she may have to practise one or more claims of the underlying invention in order to use the improvement.

Another reason why access to patent data is not synonymous with access to technology is that reading the claims of a patent is like seeing a part of a larger picture. Patent claims are legal statements to define bounds of an invention, but they are not a recipe for reproducing the invention.

Know-how (protected by trade secret and/or unfair competition law) and documentation (covered by copyright) about how to use a technology are often equally important. Even a scientist skilled in the art may have difficulty reproducing an invention based on reading the claims alone, assuming he or she can parse the peculiar syntax of patent claims.[27] In theory, patent claims should enable a person skilled in the art to reproduce the invention, and in the USA the inventor must disclose the "best mode" of practising the invention,[28] but this is not always evident for the reader, in particular if the reader is not "skilled in the art".

Study of patents issued to others may be useful in the sense that it is informative, stimulates curiosity and provides competitive intelligence about what others consider important enough to patent. It may also be useful because it often shows the surprisingly low level of inventiveness needed for a patent to issue and therefore may build confidence in the mind of the would-be inventor. It is useful to research patents on climate change technology to see whether they are protected in developing countries, and to find "holes" where a developing country enterprise can operate with impunity. This kind of patent research can be done by any developing country lawyer or patent drafter with Internet access to some modest good effect. But it is not accurate to describe patent information as a way to gain "access" to climate change technology.

The patent information approach is another "derivative" way that developing countries are said to benefit from the patent system, similar to the well-worn argument, unsubstantiated by evidence, that patent laws will proximately result in an increase in foreign direct investment and economic prosperity.

The immediate benefit of a patent – benefiting by owning it, withholding it, negotiating with it and making money from licensing it – has been, in the past, mostly for developed countries only.

Patent information is like saying that holding a piece of personal property that belongs to another in your hand is a benefit. It is not likely to work as a way to gain access to climate change technology.

2.3 Patent Pools and Commons

Patent pools have been proposed as a way for developing countries to gain access to climate change technology.[29] There is some sense that patent pools will magically, by virtue of their mechanical operation, solve the problem of access to technology, much in the way that a "commons" of works of copyright is often optimistically described as a solution to the problems of overbearing copyright owners, concentration of ownership and inadequate support for creative artists. In fact, patent pools present the same challenges to parties without substantial bargaining power as un-pooled patents.

This section defines patent pools, gives examples of patent pools and so-called commons, describes benefits and risks, and examines whether those risks should warrant concern with respect to pools proposed for access to climate change technology.

2.3.1 Definition and types of patent pool

A definition is helpful at the outset, as patent pools have long been the esoteric domain of IP lawyers and are not widely understood. Indeed, part of the mystique of patent pools derives from confusion about how they work in practice as well as the lack of consistent terminology to describe them (e.g. what is a "commons" as opposed to a pool?).

> A patent pool is an agreement by multiple *patent holders* to share intellectual property among themselves or to license a portfolio of patents as a package to outsiders [author's italics].[30]

Another definition states:

> A patent pool is an arrangement among multiple *patent holders* to aggregate their patents. A typical pool makes all pooled patents available to each member of the pool. Pools also usually offer standard licensing terms to licensees who are not members of the pool. In addition, the typical patent pool allocates a portion of the licensing fees to each member according to a pre-set formula or procedure [author's italics].[31]

The word "typical" does not apply well to patent pools: there is great variation in the purpose and operational rules of patent pools. What is noticeable is that both definitions make clear that patent pools are formed by "patent holders", meaning parties that own patents.

The term "commons" has no legal definition but connotes the desirable civic quality of a public park that charges no admission fees and is open to all members of the public. The term may be misleading, just as the word "open" is sometimes misleading, because it suggests that the commons contains only public-domain technology or is accessible without payment. What is important is to examine the specifics of any proposed pooling or commons arrangement in order to understand its operation and rules.

The following are different types of arrangement that may be described as patent pools or commons:

- *Standards consortium:* The consortium (group of companies in the same technical field, both competitors and non-competitors) is formed with the objective of promoting and evolving an agreed-upon technical standard (e.g. the Institute of Electrical and Electronics Engineers' IEEE standard). Members agree to license to all other members all patents necessarily infringed by a product complying with the technical standard ("essential patents"). The licence fees and other terms may be established by the consortium agreement or the members may agree to negotiate licences to other members with fair and reasonable non-discriminatory royalties (FRAND) or reasonable non-discriminatory royalties (RAND). Each member must negotiate with other members for how FRAND or RAND will be defined in any particular case.

- *Standards consortium with an administrative body:* This is the same as a standards consortium, but licensing is managed by a corporate entity formed for this purpose. All members license their "essential" patents to the entity and it licenses out to the members. The administrative entity may license to non-members upon terms that can be higher than or different from terms to members. In other words, non-members do not get the same deal that members get in most cases because they are not contributing IP or other support to the consortium.

- *Cross-licence:* Several companies join together to cross-license each other's patents by a written agreement. No new corporate entity is formed. No agreement is made with respect to whether patents will be licensed to outsiders (non-parties to the agreement) and such licences are left up to each party. The cross-licences may be royalty-free, or one party with a relatively smaller or less valuable patent portfolio may pay a royalty to another with a more valuable portfolio. This kind of agreement is motivated by the desire to avoid litigation risk among companies with relatively equal bargaining power. (A covenant not to sue is a licence.) A cross-licence arrangement among multiple parties may also be motivated by a desire

to promote a de facto standard (one that is not defined by a standards organization).

- *Open licensing:* This is a public commitment by a party or parties owning patents or other IP to license to other parties. The owner of the patents may publish technical information or patent text on a website stating that it is "open" (public), but not necessarily "open" (free) or "open" (permitted to be used and modified without consent). Viewers of the published material may be invited to use it for research purposes, but they agree in an electronic licence not to use it for commercial purposes without consent. At the time the user seeks consent, when it may have invested in developing the "open" licensed material, the owner negotiates financial terms and so may have strong bargaining power.

- *Dedicated patents:* Some companies agree to contribute patents to a broad low-royalty or royalty-free licensing programme. This may be because the company has decided not to commercialize the technology or it may be part of a strategy to diffuse a base technology widely in order to commercialize a related technology ("give away the razors and sell the razor blades"). An example of this was Apple's decision in the early 1990s to license QuickTime technology without royalties in order to spread the technology as a platform for multimedia applications. Patent dedication may also be part of a public relations activity to demonstrate charitable commitment.

2.3.2 Examples of patent pools in the information technology sector

The five different examples described below illustrate the wide variety of patent pools and their objectives and some of the problems they raise.

In the world of semiconductor and computer hardware technology, a number of patent pools were created in the late 1980s to promote IEEE standards (and continue today as FireWire, USB and other standards). The most well-known of these were bus and semiconductor architecture standards, where Intel was a major player and dominated the semiconductor world with its patents and royalty demands.[32] In the USA, the Federal Trade Commission began to develop law on what was good and what was bad about pools. The good was that the standard and the pool cleared the way for products from different companies to work together with a minimum of IP litigation risk. The bad was that pools and standards could strengthen the position of a company owning many patents either because smaller companies had no choice but to sign up and pay, because they had to dedicate their patents to stronger powers, or because patents that were not covered by the standard but related to it ("non-core") ended up being licensed.[33]

In the world of digital signals, the Moving Pictures Expert Group (MPEG) developed an international standard beginning in 1988 and evolving in various versions through to the present. In January 2009, it was announced that a private licensing entity called Via Licensing would manage the patent pool for MPEG-4 Scalable to Lossless (SLS) coding. Licensors offering their essential SLS patents include A*STAR Exploit Technologies Pte Ltd (Singapore), Fraunhofer IIS (Germany) and Nippon Telegraph and Telephone Corporation (Japan). The objective of this pool was described as follows: "More people using SLS technology will increase its value".[34] In other words, the pool is intended to promote a technical standard and spread the technology.

In the world of telecommunications, the 3rd Generation Partnership Project (3GPP) was established in 1998 by several telecommunications standard development organizations to make a global mobile phone

system specification.[35] In May 2009, a new telecom-munications standards pool for wireless broadband technology, the Long Term Evolution (LTE), was announced as a 3GPP extension. Like MPEG, it is to be administered by a private company. Members of the LTE pool, like 3GPP, are required to declare any patents that they believe to be essential to standards being developed or adopted. A patent is considered essential if it contains one independent claim that is necessarily infringed by the practice of the standard. Also in early 2009, another patent pool, the Open Patent Alliance (OPA) for WiMAX wireless broadband technology was formed by Intel, Alcatel-Lucent, Cisco, Clearwire, Samsung and Sprint and later joined by Huawei and Acer. This patent pool will also aggregate essential patent rights needed to implement an IEEE wireless broadband standard. The purpose of both pools is described as promoting technical "interoperability at a more predictable cost" and reducing the IP cost for developers to develop applications that will work on devices sold by pool member companies. Of course, another purpose is to collect royalties. In this case, "open" does not mean royalty-free.

In the world of computer software, Linux, the software behind Open Source, is based on a commitment to a published standard and to free licensing anybody who agrees to certain requirements. In that sense, Open Source is a kind of IP pool. In 2005, a private company called Open Invention Network℠ (OIN) was formed with backing from IBM, NEC, Novell, Philips, Red Hat and Sony as a "collaborative ecosystem" based on "a refined model of intellectual property".[36] OIN buys patents related to Linux and "important" patents owned by OIN are "openly shared" and are available royalty-free to any company, institution or individual as long as it agrees not to assert its patents against the Linux components, a sort of core Linux.[37] OIN backers such as IBM retain the right to assert their patents on technologies that are not part of the Linux core components. Participation in a pool does not insulate members from patent claims from non-members. As one clever commentator put it, "Microsoft went Bam Bam on [Linux developer] Tom Tom" for patent infringement in 2009 and forced a royalty-paying settlement.[38]

2.3.3 Important considerations raised by patent pools

As can be seen from the above examples, in business contexts patent pools are generally not created to further altruistic concerns and do not usually involve royalty-free licences. The members of patent pools are generally large companies with strong IP portfolios. The most common stated reasons for pooling patents are promotion of a technical standard, promotion of interoperability (technical products sold by different companies but that must work together, e.g. printers and computers), elimination or reduction of litigation risk among parties with multiple patents ("patent thickets"), and the creation of a broadly accepted technology platform that will encourage further investments by developers (e.g. computer hardware or an operating system platform that encourages software application developers to write software). This is the sunny side of patent pools.

The unstated goals of patent pools – the shadowed side – may be to make it easier to collect royalties from infringers and the desire to stabilize prices and minimize competition.[39] The former goal – ease of patent enforcement – may be desirable from the point of view of companies with large patent portfolios, and is certainly legal, but is not an advantage for small players and non-members. Often pools are part of a business strategy to propagate a core technology as a standard, which will then be the basis for development of non-core technologies that will be licensed for profit. This is not an inherently bad strategy, but it is not always understood by observers who are impressed by the fragrant jargon flowers arranged around the pool (e.g. "open", "collaborative ecosystem," "promoting competition", "predictable costs," "unique model").

The price fixing/anti-competition objective is, of course, illegal under any anti-trust laws: a cartel may not form a pool of patents in order to destroy competition among the pool members or outsiders by setting royalties or other financial terms in a consistent way or by dividing markets. Indeed, historically, competition authorities have worried that patent pools may cloak criminal cartel behaviours, such as fixing prices and driving out small competitors, with innocent justifications.[40]

The same caution should be employed when observing the sunny and shadow side of patent pools offered to developing countries by emerging climate change technology powers. Realistically, for a corporation, the purpose of patent pools is not to equalize disparate bargaining power but rather to promote technical engineering goals such as interoperability and in some cases to avoid litigation among relative equals in patent power. Why should a patent pool managed by large competitors owning significant climate change portfolios offer a win–win deal on access to a developing country pool member or non-member, when the developing country party has low bargaining power (because it does not own patents, has limited capital, and does not have a potential for volume distribution of technology products)? Will a patent pool membership have the unstated price of making it easier to enforce patents that would otherwise be "below the radar"? In other words, in order to get a clear picture of patent pools for development, we must look at the shadow as well as the bright side.

2.3.4 Patent pools and "commons" in the areas of health and climate change

Recent publicized proposals for "charitable" patent pools deserve a close look. In the pharmaceutical arena, Glaxo earlier this year announced that it would cut its prices to least developed countries (LDCs) for all drugs, invite scientists to study tropical disease at a research institute in Spain, reinvest 20 percent of profits from LDC sales to hospitals, and form a patent pool for chemicals and processes relevant to finding drugs for neglected diseases. Upon close examination of the offer, one sees that: (1) the patents will be available for licence at fees to be negotiated; (2) the patents in the pool "are not generally filed in LDCs" so they would be public domain in LDCs in any case; (3) the licences will be considered in research areas that Glaxo is not itself pursuing; and (4) where the potential licensee wants to sell into *non-LDCs* too, Glaxo would want the licensee to pay royalties or grant back a license to Glaxo "to allow us to sell the products into non-LDCs countries ourselves".[41]

In 2008, UNITAID proposed a patent pool for AIDS medicines.[42] It would be a voluntary pool of patents, to which pharmaceutical companies would license AIDS drug patents for the purpose of encouraging broader distribution of these drugs in developing nations. The pool licence would be royalty-bearing, so whether the pool is truly a step beyond the current state of affairs remains to be seen. It appears that no pharmaceutical companies have yet licensed patents to the pool. The rules for pool management have not yet been announced, so it is difficult to assess how it will work. In general, the announcement and the tentative support it has received from Gilead, Glaxo and other major pharmaceutical companies show that they are willing to consider what is essentially voluntary licensing on a case-by-case basis, which is a positive development. The financial terms of the licences, the scope of the licences and who will qualify to become licensees remain to be seen.

In the climate change technology domain, the World Business Council for Sustainable Development (WBCSD) has established an "Eco Patent commons", a "collection of patents that directly or indirectly protect the environment". Members pledge patents to the pool and agree not to assert pledged patents against anyone who uses the patent for an "environmental purpose". Non-pledgers (non-members) can practise the patents, but if they make any

patent claim against the member, *whether or not related to sustainable development*, the licence will be subject to "defensive termination". In other words, a non-pledger who wishes to use a single patent in the pool must "pay" by granting free a licence to all of its patents. Members will be terminated only if they assert a patent against another member that is in the patent classes identified for the sustainable development pool.[43]

The attractive part of the WBCSD pool is that the patents are licensed royalty-free. The less attractive part is that the pool itself is small (around 80 patents appear on the web listing) and that non-members can be cut off for making claims against a member whether or not the claim is related to sustainable development. Also, the patents listed are not necessarily filed and protected in developing countries, and so the value add of the pool is limited.

Most importantly, the WBCSD pool does not confer any rights to know-how, trade secrets or documentation. Although theoretically patents should enable a person skilled in the art to practise the invention, in practice the details concern only the specific claims of the patent. Useful technology transfer generally requires a set of patents and other IP, plus documentation and sharing of know-how. This is usually done between businesses in development collaboration agreements, where the IP licence is incorporated but is only one element of value in the transaction. The WBCSD website points out that members may be willing to enter into collaboration agreements, but the problem of lack of bargaining power is likely to arise in the negotiation for collaborative development for any developing country party that is without capital, IP assets or something else to offer.

2.3.5 Summary

In sum, relying on patent pools as a way to access climate change technology has the following limits:

- Pool licences may be open but they are generally not free. Even a "reasonable royalty" for use of an energy technology portfolio owned by wealthy country parties adds a cost burden. Developing country research institutions and companies could be saddled with a tax (a royalty) on their own development and commercialization of energy technologies.

- The pool licence is often intended to clear IP hurdles between owners of IP, not to deliver technology to non-owners, and so is devoid of documentation, instruction and know-how. The financial and other terms of collaboration agreements and technology licences must be negotiated for useful technology transfer.

- Pool licences do not eliminate inequality in bargaining power, and what is a "reasonable royalty" must be negotiated, just as such terms must be negotiated in non-pool collaboration agreements and technology licences.

- Pools may offer licences to patents that developing countries can use anyway, because the patent owners often do not file there.

- Pools help patent owners to create a large powerful patent portfolio that increases their patent power and could be used for enforcement against weak developing country parties.

- Pools that require contribution of technology risk unprotected disclosure of endo-genous developing country technology, which may diminish developing country party control over these technologies and the value they can extract from them.

- The pool in climate change context is unlinked to any technical standard, and

so the competitive justification for the pool is hard to define. There is no "core" technology that permits a pool member to make climate change products in the "non-core".

- Patent pools are hard to manage, especially from a distance. Often, private companies are used to manage the pool and such companies operate for profit. This cost is necessarily passed to members, including developing country members, unless the pool is strictly charitable in its nature.

Developing countries can use the above list of concerns in assessing proposals in climate change negotiations to establish patent pools for accessing climate change technologies.

In many ways, the pool metaphor is a good one. Technology standards organizations are like a club in which participants agree to abide by a set of rules, including paying dues. The benefits of club membership include permission to swim in the pool, but for those who cannot swim well (who don't own patents) it may be unpleasant to jump in. There are shadow and sunny sides to the pool.

2.4 Structured Licensing Mechanisms

Proposals for addressing the need for technologies have included the idea of creating "mechanisms" whereby developing countries could receive intellectual property licences to use climate change technologies from developed country licensors.[44] The rationale for these proposals is that developing countries can benefit from a self-executing, possibly centralized (global) procedure that avoids the difficulties and vagaries of licence negotiation.

There are many variations on the same theme of a grand mechanism that will avoid or overcome technology transfer problems and deliver climate change technologies to developing countries. These include "clearing houses", digital rights management projects to automate contracts, downloading of readymade form contracts embodying "fair and reasonable" terms, outsourcing of technology transfer management to services companies staffed by developed country personnel, and packets of preselected patents and other forms of IP corresponding to the licensor's notion of what is needed to implement green technology solutions.

The common theme in these proposals is an assumption of dependency and passivity.[45] Many feature developing countries as recipients and licensing professionals from developed countries as managers. Although there are some useful aspects to these proposals, whether they would work should be examined carefully.

The proposal for a "single-window facility" for climate change technology transfer by Sarma (2008) envisions a "technology transfer mechanism" (TTM) that would be the "focal organization and ... single window facility (like the financial mechanism of the Montreal Protocol) through which all the programmes of all the agencies pass".[46] Eligibility to participate would be decided on the basis of per capita income or per capita emissions. An international panel of experts would decide who gets what and would set technology priorities based on an annual report on the "latest developments in technologies". Each country would manage coordination with the mechanism at the national level and set up "specific voluntary goals". The TTM would be administered by an executive committee of donors and recipients, assisted by a secretariat. The TTM would make all decisions on country programme approvals.

This TTM seems too bureaucratic to work well. How could it assess the current state of technologies, negotiate technology licences and development agreements, and appreciate the actual needs of each developing country? The cost of such a mechanism would surely outweigh its utility. Although there could be excellent results from such an operation, it seems to be more of an international aid project management programme. It bears no resemblance to a technology management office.

The difference between project management and technology licensing is that the latter is

based on the idea of sustainability through generation of technological improvements and creation of enterprises. A licensee can develop the technology, start a new company, create jobs, find synergies with other companies, enter markets and handle the technology as it sees fit within the framework of the licence agreement. Non-exclusive licensing can create even more synergies when multiple parties participate in developing a "platform" of related technologies. By contrast, a project may be over when physical construction is completed. Successful non-exclusive technology licensing lets a thousand flowers bloom;[47] successful project management grows plants in a pot.

Precedents for packaged licensing programmes include the Public Intellectual Property Resource for Agriculture (PIPRA), a consortium of universities and research institutions that offers licences to agricultural patents.[48] PIPRA also develops guidelines for licensing and sponsored research to encourage overall development of research innovations for use in agriculture while also retaining rights that member institutions need to fulfil their mission of research and product development for the broader public benefit and humanitarian purposes. Still, the fact remains that PIPRA offers royalty-bearing licences to IP owned by its member institutions that are, by and large, developed country institutions. Its success in terms of benefit to developing country institutions has yet to be documented.

Model contracts are useful when understood as a tool that can be used by people trained in licensing, usually lawyers or businesspeople with licensing experience. The terms of model contracts reflect the positions and assumptions of the parties drafting the model contracts. So, for example, one of the most important issues in a licensing contract is the scope of the licence grant. Imagine a licence contract for a patent, documentation (copyright work) and know-how (trade secrets) relating to wind energy. Is the patent owner granting the licensee broad rights to make, have made, use, sell, import and sublicense wind turbine functionality covered by the claims of the patent, plus the right to modify and distribute software and documentation under the licensee's company name? Or does the licence grant include no rights to sell products practising the patent claims? The latter licence is far less valuable than the former and may be value-less. There are hundreds of variations and options in a licence agreement, and it would be difficult for a model contract to define "neutral" positions that would fit multiple contexts.

Technology contracts differ in their form and content. No one form contract suits all circumstances. For this reason, it is key that developing country personnel be trained in negotiation of technology licensing and development collaboration agreements. This is an urgent need because only through experience and knowledge of practical IP skills will developing countries be able to use the system to their advantage. No automatic programmes or packaged portfolios by developed country parties can substitute.

It may be argued that "that's what lawyers are for" and that developing countries do have lawyers. However, what is needed is training of lawyers and other professionals in the special skills needed for effective negotiation of technology contracts. In both France and Senegal, a divorce lawyer will not necessarily have the skills to handle an IP licence negotiation. The good news is that training lawyers in technology licensing skills is not difficult, as the base skills of contract interpretation are present.

Acknowledging the weakness of model contracts, an annotated set of model contracts is useful as a training tool. The annotations could explain the impact of choices of terms and would be a useful exercise. However, the utility of such a project would depend on its being used as a tool to empower people in developing countries to negotiate on an informed basis. Ideally, the project itself should be designed and developed with full participation by developing country personnel

who have experience in negotiation technology transfer contracts, in partnership with an organization of skilled professionals interested in the transfer of technology or licensing of IP rights such as the Licensing Executives Society.[49] Any project that seeks to automate licensing decision-making, especially one designed by developed country parties, risks compounding the problem of lack of bargaining power.

Finally, automated licensing mechanisms do not address the central problem of negotiation of technology contracts: inequality of bargaining power. Best-practice guides may be useful, but the real problems are lack of training and lack of bargaining power. This can be addressed by training programmes in practical skills and by attempting to grow developing country patent ownership of climate change technologies, an ambitious but doable task over the medium to long term.

All of the above approaches may have some utility, but only in the context of innovation strategy that will empower developing countries to own and manage their own climate change IP. Resources that could be devoted to addressing the real problems of lack of bargaining power and weak innovation infra-structure should not be diverted to these approaches.

3. WHAT CAN WORK: A TWO-PRONGED APPROACH

What can work to secure access to climate change technology for developing countries is a sustained two-pronged effort to implement climate change innovation strategy (CCTIS) in developing countries, and to enter into mutually beneficial development collaboration and IP licensing agreements between developed country companies and research institutions and their counterparts in developing countries.

3.1 Climate Change Technology Innovation Strategy

Innovation strategy is a medium- to long-term strategy followed by countries that have succeeded in technology development and commercialization. In brief, it is the management of national research in order to turn useful research results into an economic asset (as IP) and to facilitate the commercialization and distribution of such useful research results. In the private sector context, this discipline is referred to as "IP asset management" and is a recognized professional field.[50] In the public sector, this strategy is often referred to as "innovation strategy" or "IP strategy" and is generally implemented in parallel with national industrial policies in capitalist, socialist and mixed economies.[51]

Innovation strategy is *not* public relations relating to innovation, such as innovation fairs that often feature unprotected inventions and tout the achievements of developing countries in IP enforcement. The goal of innovation strategy must be to strengthen research, increase IP ownership by national parties, and support capacity to commercialize technologies in national, regional and international markets.

The examples of two very different countries, China and Cuba, demonstrate the success of innovation strategies (Box 1).

Box 1. Innovation Strategies in China and Cuba

China

China follows a policy that it refers to as "self-innovation" or "independent innovation". As Premier Zhu Rongji stated in a 2003 address to the People's Congress:

> We need to promote the development of a state innovation system. We should effectively strengthen our basic and high-tech research and enhance our capabilities for scientific and technological innovation and competition. We should lose no time in implementing the State Plan for High-Tech Research and Development and the State Plan for Development of Basic Research in Key Areas, as well as major projects for science and technology development. We should master core technologies and *win proprietary intellectual property rights in key areas and some frontier fields of science and technology*. We should strengthen the infrastructure for science and technology [author's emphasis].[52]

What is striking about this statement is the reference in the penultimate sentence to the need to "win proprietary IP rights", clearly a strategy decision to claim ownership over technologies. What is also striking is the strategic sophistication of targeting "core" technology areas and "frontier fields". In other words, China is building up technology ownership using IP as a tool, in order to own a technology platform. The core areas that China has sagely selected include nanotechnology, materials science and storage (batteries), three critical platforms for climate change technologies. Ownership of patent

Box 1. Continued

portfolios in these areas will make it possible for China to demand royalties on many climate change technologies that rest on these platforms.

China enacted its first patent laws in 1984 and amended them in 1992, 2000 and 2008. At each juncture, China implemented elements of its innovation strategy. For example, before the 2000 patent law amendments went into effect, the country implemented an effective programme to train more than 5000 patent drafters so that they could service Chinese research institutions and companies.

At the same time that China published numerous white papers on "IP protection",[53] it also developed and implemented an IP strategy.[54] Chinese commentators pointed out:

> The first two decades of this century are a crucial period for China's development, and equally important in formulating a national IPR strategy to turn China into an innovation-oriented country and enforce national innovative ability and realizing the target of building a well-to-do country.[55]

China's success in executing IP strategy may be measured by the significant increase in patent application filings in China and also in filing patent applications through the PCT facility of WIPO.[56] There is no precise way to measure how many patent applications have been filed by Chinese inventors relating to climate change technologies because the international patent system does not have a classification for this general category. Climate change technologies include and cross over multiple patent classification categories.

Consistent with China's national innovation strategy and contemporaneous with it has been a massive economic stimulus initiative in response to the current international economic crisis.[57] Elements of the Chinese stimulus programme include investment in tertiary education, green technology research and development (R&D), and initiatives to promote new venture formation in key green technology domains including batteries, electric vehicles, nanotechnology, thin film and materials development, and photovoltaic solar cell development.

Cuba

By contrast, Cuba is a small country that has endured economic hardships, is capital-constrained and has few natural resources. It is, however, one of the most effective user of patents in a target technological field in North and South America.[58]

Cuba's innovation strategy targets medical biotechnology and has been coordinated with its social policy of providing state-of-the-art medical care for its citizens and for export. Cuban scientists patented a new treatment for cervical cancer in 2006,[59] and University of Havana scientists jointly developed and patented with Canadian scientists a vaccine against pneumonia and meningitis.[60] Cuban institutional IP policies are strong and clear: they will negotiate technology licences to commercialize their research, but they do not waive or abandon patent rights. This policy and their patent portfolios have enabled Cuba to enter into numerous licensing agreements that earn revenues but, more importantly, distribute medicines.

Beyond the examples of China and Cuba, small countries and LDCs can strategize for how to build value from their intellectual capital, including participation in regional networks and making savvy decisions concerning target clusters (e.g. Cuba in biotechnology). Barbados is an example of a small country that has developed and commercialized science in solar energy and biomass.[61] Colombia has recently created a network of national research institutions working on new energy technology.[62] Cameroon and other central African nations formed a research network of universities engaged in medical research.[63] Thailand's eminent universities have made strong advances in biotech and medicine. Ethiopian scientists have made significant contributions in tropical medicine. Singapore universities are working dynamically in green construction and in water technologies and developing an important IP portfolio through the national agency for scientific research, A*STAR, and its expert technology management arm, Exploit Technologies.[64]

Innovation strategy is not a "one size fits all" approach. Small, very poor countries will have a more difficult time than BRICS in trading on their human capital, but these handicaps would be true for any programme of development. LDCs will need to tailor innovation strategies to their needs and capacities. LDCs can join networks and engage in south–south collaborations as a way to gain economies of scale and participate in larger regional innovation strategy. IP, far from hindering that participation, can be helpful because small actors can claim economic value in intellectual capital.

Innovation strategy means investing in national intellectual capital and in infrastructure to enable developing country parties to commercialize research results so that they can achieve a return on that investment. The second prong of the approach recommended by this paper relates to how developing countries can commercialize technology. Universities and research institutions in developing countries need to enter into balanced voluntary licensing and development collaboration agreements that recognize the full economic value of their intangible assets.

3.2 Technology Collaboration Based on "Win–Win" Contracts

The second prong of this approach is to promote mutually beneficial ("win–win") technology contracts to spread climate change technologies. A win–win technology contract results when the material terms of the contract provide that both parties contribute relatively equal value to a technology transaction and stand to gain relatively equal benefit. Contracts where both parties win in relatively equal amounts are considered sustainable because the parties willingly abide by the terms. By contrast, win–lose contracts, or contracts where one side has a considerably greater benefit than the other, tend to create unstable business relationships because over time the losing party will try to avoid the contract terms or terminate the contract. Three examples of win–win contracts are provided in Box 2.

Box 2. Win–win Technology Contracts

- *Example 1*: A licensing agreement whereby a scientific team at a university owns a patent, which it licenses to a business that will pay royalties to the university upon sale of products using the claims of the patent.
- *Example 2*: A joint venture whereby both parties invest human capital, funds or use of facilities, and other items of value, in order to develop a wind turbine design for high rainfall climates, and the parties agree to joint ownership of IP with distribution rights in different geographic territories.
- *Example 3*: A developing country puts out a bid for a magnetic, high-efficiency public transport system and accepts an offer from a developed country company that offers an IP licence to patents and documentation relating to the transport system, plus engagement with engineers from the local university.

By contrast, examples of unbalanced technology contracts abound, especially in transactions between developing country and developed country parties, often universities. Box 3 provides examples of one-sided contracts where one party wins more than the other.

Box 3. One–sided Technology Contracts

- *Example 1*: A developing country university sells a set of plant extracts or "candidates" for enzymes in exchange for a low fixed sum to a developed country research institution, which will screen and select candidates to find those worth further research and patenting. A promise is made to consider "equitable benefit sharing" when appropriate and in good faith.
- *Example 2*: A developed country scientist licenses an invention plus all future inventions for a one-time payment of $25,000.
- *Example 3*: A developed country energy company enters into a build-to-own contract in a developing country whereby it provides equipment and technology for a wind facility but offers no IP licence or training of local engineers. The developing country agrees to buy its energy requirements from the facility and in exchange gets to own the equipment in 20 years.

The link between the first prong of the approach that this paper recommends, CCTIS, and the second prong, win–win technology contracts, is tight. The first set of examples of win–win contracts (see Box 2) all involve contexts where developing country parties have negotiated effectively using their own intellectual capital as an asset, with explicit terms for how IP will be handled. The second set of contracts (see Box 3), win–lose or win–lesser benefit, arise in situations where the developing country parties have not asserted their intellectual capital as an economic asset. The absence of an implemented national innovation strategy has made it difficult for the developing country party to claim and assert a value for its intellectual capital.

Indeed, it may be said that the intellectual capital of the parties in a state without innovation strategy is often treated as free or value-less. Where one side holds a valued asset and the other side is considered to have no valued asset, the resulting negotiation will be unproductive and the resulting contract will be unbalanced.

The specific elements of innovation strategy lay the foundation that makes mutually beneficial technology collaboration contracts possible. Without technology innovation strategy as a foundation, it is as difficult to achieve win-win technology contracts as it is to build a house without a foundation.

A critique of the approach that this paper recommends is that it relies on a long-term strategy to address an acute crisis. Immediate solutions, it is argued, are needed. This criticism is certainly apt, but meaningful short-term solutions are difficult to define if a long-term innovation strategy is missing. Saying that only immediate solutions are appropriate is like a doctor greeting a patient with the diagnosis of a serious illness but stating that he or she can only give the patient an aspirin because the real treatment for the condition is too expensive and would take too long because the office closes at 5pm.

It is preferable to begin innovation strategy as a long- to medium-term solution, while simultaneously pursuing short-term solutions that are consistent with the innovation strategy. A thoughtful and practical initiative for short-term action, "green technology packages", has been put forth by Naoto Kuji of Japan (see Box 4).

Box 4. Green Technology Packages

The "green technology packages" initiative has been put forth by Naoto Kuji, General Manager, IP Division, Honda Motor Co, and former president of the Japan Intellectual Property Association. According to the proposal, green technology owners should begin now to engage in open innovation, licensing out packages of patents, copyright works and know-how in order to spread green technologies to avert climate change damage. He proposes a "package" because sets of patents, documentation and other IP and non-IP know-how would be combined in such a way as to facilitate utilization by the licensee. Royalties would be paid by the recipient of the green technology package, as in any business transaction, when the licensee makes and sells products derived from the package. For developing country licensees, Kuji states: "In case of a developing country affirming its commitment for CO2 reduction ... it seems effective that payment can be made to the technology owner by, instead of the said country's authorities, public funds ..."[65] So, for developing countries, Kuji's plan assumes public financing to compensate technology owners.

Under Kuji's proposal, green technology packages from major patent owners would be licensed to developing country parties with provisions for royalties, so that some of the payments would be made later, when the developing country partner succeeds in achieving revenues. Like all royalty-based transactions, this arrangement spreads risk and permits a party that cannot afford to pay upfront to pay later when it realizes sales. The licensor is willing to engage in this because the prospect of a royalty gives it an opportunity for "upside" – that is, cumulative licence royalties that are greater than a lump sum payment at the time of signing. The licensor may also be motivated to license out its technology in order to spread the technology more broadly into new markets. The licensor may also be motivated by a humanitarian desire to see climate change technologies put to use. The licensor may consider differential licence terms, offering financial terms commensurate with market prices and project costs in developing countries.

A complement to Kuji's proposal would be to encourage the engagement of developing country universities and research institutions in green technology package licences. This engagement would consist of contractual commitments by the licensor to training, participation of developing country researchers and also IP ownership by the developing

Box 4. Continued

country participants of their intellectual contributions. Eventually this may lead to "grant backs", licensees and cross-licences, enriching the green technology package. In this way, the green technology package programme could become a sort of Linux for green technology application development. Whether this will work will also depend on the licensor's willingness to license out core technologies that can serve as the basis for application development.

Kuji's proposal underlines the logic of the IP system, while acknowledging the importance of change and adaptation to make climate change technologies available and to harness the talents of developing country scientists. One challenge will be to achieve agreement on pricing and payment, no small matters in contract negotiation. Whether such green technology packages can be negotiated successfully between developed and developing country parties remains to be seen, but a coherent and implemented CCTIS will likely increase the bargaining power of the developing country negotiators. In the medium to long term, innovation strategy may change the negotiation dynamic entirely.

4. RECOMMENDED ACTIONS FOR ACCESS TO CLIMATE CHANGE TECHNOLOGY

Developing countries can draft, implement, test and evaluate national innovation strategies focused on investing in, protecting, valorising and commercializing national intellectual capital in targeted climate change technologies. Study of existing innovation strategies shows that they follow a formula that can be repeated and customized to fit the needs and capacities of any country. The IP Audit Tool developed at WIPO is one practical checklist for how to develop and implement national and regional innovation strategy.[66] Another rich source of information is the innovation strategies of China, Japan, the EU, Canada, Singapore, South Africa and many other nations, most of which are publicly available.

Each country must tailor innovation strategy to its own needs and policies. Still, innovation strategies have common elements, including identification of one or more target technology clusters (e.g. biomass or solar or waste to gas or geothermal); funding related science education at primary, secondary and tertiary levels in national budgets; funding graduate student research; operating technology incubators to provide legal and business services; training of professionals in key skills such as patent drafting and contract negotiation; bridge financing and loan guarantees for SMEs in target areas; and clarification of laws and policies on technology commercialization at research institutions.

Based on the analysis and argumentation developed above, this paper makes specific recommendations for action in five general categories. The first is with respect to IP management in general and the last four in particular respect to climate change.

1. *Management of developing country intellectual capital:*

   (a) Train developing country professionals in practical (not theoretical) IP skills, such as drafting patent claims, negotiating contracts and marketing technology.

   (b) Discount and/or subsidize filing (and search and examination fees) for patent applications from developing country research institutions and SMEs so that these fees are affordable to such institutions.[67]

   (c) Adopt institutional IP policies at research institutions that reward IP protection of research results and clarify ownership of IP.

   (d) Evaluate the effectiveness and performances of national IP offices based on their responsiveness to national science and business institutions.

2. *Support for endogenous climate change R&D:*

   (a) Establish an international fund to match developing country commitments to targeted climate change research and development at developing country universities and other research institutions, including funds for laboratories, faculty salaries and graduate student bourses.

   (b) Set a minimum 1 percent goal for university based-R&D as a percentage of gross national product (GNP) and exempt such R&D allocation from budgetary debt service.

   (c) Form and fund regional R&D Networks of existing indigenous research institutions in developing countries for climate change technology development and commercialization that permit sharing of resources and cost for innovation infrastructure and expensive equipment.

3. *Climate change technology commercialization:*

   (a) Capitalize and operate an international financing and guarantee facility for climate change technology commer-

cialization in developing countries, including seed and bridge capital for start-up businesses and for development collaboration agreements.

(b) Use tax policy to promote private venture capital investment in climate change technology.

(c) Promote voluntary licensing and development collaboration in climate change technology between developed and developing country parties by offering tax incentives, guarantees, subsidized debt and other encouragements.

(d) Use green technology packages (see Box 4) as a way to kick-start climate change tech R&D in developing countries.

4. *Education and awareness:*

(a) Highlight the role of developing countries in finding solutions to climate change by establishing an international prize for climate change research in developing countries by developing country scientists, and by publishing articles, films and other educational media.

(b) Invest in primary-level science education in developing countries and teach children that there are opportunities to become research scientists in their own countries.

(c) Establish an annual climate change science and technology symposium to be held in a developing country to encourage "brain gain" and contacts between diaspora scientists and students and researchers in educational institutions in developing countries.

5. *Periodic assessment:*

(a) Track patents filed by developing country inventors, licences signed, development projects undertaken, educational programmes and other measurable milestones in CCTIS.

(b) Link the success of CCTIS to TRIPS implementation timetables and compliance.

The periodic assessment component is important because an IP strategy must deliver practical and measurable results over time. TRIPS was implemented with delayed timelines for developing countries and LDCs for a reason: the notion was that by 2016 – in the case of LDCs – the benefits of embracing the IP system should be manifest. Linking CCTIS to TRIPS implementation is important because, in the final analysis, if developing countries and LDCs do not succeed in becoming IP owners, or gaining some other measurable benefit, then the imposition of a uniform IP system on them is fundamentally unfair.[68]

It is true that CCTIS is an expensive strategy. Implementation of the specific recommended actions above will be costly, but the resources will be spent primarily in developing countries to support technology development by developing country actors. Funds will not be wasted on consultancies, databases, conferences, studies or international bureaucratic management, but will go primarily to science faculties and students at developing country institutions such as the University of Makerere in Uganda, the University of Ghana at Legon, the University of Cameroon, the University of Mexico, Malaya University, Hanoi Institute of Technology and Chulalongkorn University in Thailand. Success will not occur overnight, but measurable success will occur incre-mentally. Climate change technology will evolve and grow, with contributions from developing country scientists and researchers. The mythology of "technology transfer" will be replaced by the reality of technology exchange and collaboration.

Developed countries can support this strategy by contributing capital to the funding facilities, possibly through development banks, enacting tax incentives to encourage companies to

engage in voluntary licensing, offering discounts for patent filing and search and exam fees for developing nations, contributing to international prizes and lending professional trainers in key IP skills.

At the policy level, developed country governments can help by recognizing the importance of policy and budgetary "space", so that developing countries can prioritize investment in education and R&D. Resource extraction contracts can include provisions for taxes for national climate change technology research, and developed country leaders can support such initiatives rather than criticize them. Private companies in developed countries can take the initiative to offer green technology packages with attractive terms and conditions designed to move new climate change technologies into emerging markets.

5. UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE DRAFT RECOMMENDATIONS FOR "ENHANCED ACTION ON TECHNOLOGY TRANSFER"

Some of the UNFCCC draft recommendations under consideration at the time of writing[69] show a lack of familiarity with how technology transfer and IP work in practice. Technologies are not like sacks of maize that are delivered, deposited, distributed and then consumed. They must be exploited by people who can use them, and then be developed, evolved and adapted. This requires empowering human capital of developing countries in universities, research institutions, business and government.

As a further example, the UNFCCC draft appears to assume that compulsory licensing is not currently available to developing countries, which is not correct as discussed above.

The draft also advocates that LDCs "should be exempted from patent protection of climate-related technologies for adaptation and mitigation, as required for capacity-building and development needs". This may be a good idea, but it seems unlikely as most LDCs have already adopted patent laws or committed to regional patent management (e.g. OAPI and the Bangui Agreement). Also, most developed country parties do not file patents in LDCs anyway, so this would be a huge political fight for nothing. Finally, LDCs could be markets for developing country climate change technology. There does not seem to be an understanding that currently developing countries are legally free to practise patents that are not filed in their own countries or export markets. Another important misunderstanding is the notion that delivery of documentation (e.g. patent documents) is technology transfer.[70] Information and documentation are distinct from practical knowledge.

The draft recommendations need to be pruned. Some recommendations are too general to be useful. Others propose very expensive projects with unclear deliverables in terms of the objective of gaining access to climate change technology. Important recommendations on funding, incentives, and promoting licensing and development collaboration need to be detailed and made concrete.

The relationship of developing country climate change technology and carbon credits needs to be clarified. A most unfortunate result would be for developing countries to become carbon credit vendors to carbon mammoths for the cheap price of illusory technology transfer projects.

The draft recommendations on technology transfer need to be sharpened and focused on how technology transfer functions in the "real world". In this respect, the following suggestions are submitted for further consideration:

First, there needs to be an explicit recognition of the role of developing country universities and research institutions in climate change technology. The developing country scientist, struggling for funding and recognition, is the "invisible man",[71] although it is precisely these individuals who are capable of creating rich intellectual assets that can give bargaining power to developing nations. It is as if technology collaboration is a play that is realized without developing country actors. Any serious strategy for international climate change technology collaboration must work to make the developing country scientist visible and prominent. Although brain drain has diminished the ranks of scientists in developing countries, it has not eliminated them. Enhancing the role of developing country climate change scientific and research institutions should be central to declarations or other instruments adopted in the UNFCCC process.

Second, the invisibility of the developing country scientist in the draft is related to the larger issue that the draft assumes that access to climate change will come to developing countries through the efforts of

developed country parties.[72] The UNFCCC process can shift this focus to an approach that is both more empowering and more pragmatic, whereby developing countries claim their power to participate in climate change technology. The two prongs of such an approach, and their more detailed elements, are delineated in this paper: CCTIS and "win-win" technology contracts.

Third, there should be less emphasis on "mechanisms" as a magic way to somehow leap over the fundamental problems that developing countries face, namely lack of funding for education and research, lack of bargaining power, and lack of capacity in practical skills such as technology management, contract negotiation and patent drafting. Pools, patent information databases and structured licensing mechanisms are all found in the recommendations, but for the reasons detailed in this paper they are likely to be of limited effectiveness to developing countries. The likely result will be gains for IT companies and IP professionals based in developed countries, and for companies with strong patent portfolios.[73] Similarly, the focus on technology mapping and patent landscaping should be re-examined to determine what the actual deliverables would be and in what way such deliverables would deliver concrete benefits to developing countries.

Fourth, there should be more emphasis on how IP works in practice. The recommendations briefly reference "measures to address intellectual property rights". This needs to be turned to a different angle: "Measures to address the need for building developing country intellectual property assets". Current documents and discussions do not address the critical importance of developing country research being supported and valorised – that is, becoming the subject of patent applications by developing country parties. And yet this is fundamental if developing countries are to engage in the types of technology transfer deal that this document envisions.

Finally, the current drafts and discussions need to be more specific on funding initiatives. If there is to be funding for climate change technology for developing countries, then who would be the recipients? Specific measures and facilities for funding climate change technology research, development and commercialization in developing countries by developing country parties need to be addressed and detailed. The Copenhagen debate should put more emphasis on international financial support for national technology innovation plans based on national needs and capacities (as defined by developing country parties), and *less emphasis* on creation of an international bureaucratic structure to collect and evaluate technology and technology projects. Scientists must do technology assessment, preferably in developing countries. Technology plans should be developed on a national and possibly regional basis; tasking international bureaucracies with analysing technology and making plans applicable to all countries is paternalistic,[74] underestimating both the complexity of technology and the capacity of people in developing countries to analyse their needs and capacities.

6. CONCLUSION

Developing countries urgently need climate change technologies. What will work? In order to get climate change technology, they will have to create parts of it themselves, claim it as IP and find ways to treat their intellectual capital as an economic asset. This requires a medium- to long-term CCTIS. CCTIS will give developing country parties the bargaining power to engage in win-win contracts for climate change technologies.

IP will have to become a tool of developing countries in their struggle to gain access to climate change technology, not a whipping boy for the multiple inequalities and inequities that exist today. Developed countries will have to stop making the IP system difficult for developing countries, recognizing that IP ownership is what makes the system interesting.

Above all, concrete measures for funding climate change technology research and commercialization in developing countries must be proposed, debated and sharpened. Gimmicks and jargon such as “mechanisms”, “commons” and “databases” need to be scrutinized to see whether there is real value. No mechanism will offer bargaining power to developing nations or shortcut the process of building bargaining power from intellectual asset development. The international debate on developing country access to climate change technology needs to focus on a practical strategy that will work.

ENDNOTES

1. See the revised negotiating text from the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) at its sixth session, FCCC/AWGLCA/2009/INF.1, 22 June 2009. http://unfccc.int/resource/docs/2009/awglca6/eng/inf01.pdf.

2. Developing countries are located in arid zones, where water scarcity is already a problem, or in low-lying tropical zones, where inundation is a threat. For a detailed discussion of climate change and its impact on developing countries, see Ravindranath and Sathaye (2005), pp. 3–5. See also IPCC (2007).

3. This paper assumes a definition of technology transfer that does not include transfers from a developed country company to its controlled subsidiary, location of manufacturing facilities/sales offices, sales of technology-based goods, and other situations where the developing country parties' role is essentially passive. By "technology transfer" and "access", we mean only situations where developing country parties are enabled to use and evolve technology in their own institutions and businesses, because they receive an IP licence and/or a binding contract for collaborative development, training, documentation and know-how.

4. Perhaps the best evidence of this has been the failure of Article 66.2 of TRIPS to achieve meaningful transfer of technology.

5. See text at note 71.

6. An exception to this statement is the overreaching demands of TRIPS Plus, which transforms centuries of IP law and include new quasi-IP investment protections such as data protection, plant variety protection, database protection, copyright term extensions and limits on compulsory licensing.

7. An interesting parallel may be drawn with the contention of de Soto (2000) that failure to permit poor people to claim and document property forestalls economic growth in developing countries.

8. According to the WIPO (2008) *World Patent Report*, "non-resident applicants accounted for almost all the filings at the patent offices of ... Mexico". Further, the report notes that "emerging economies" accounted for only 2.5 percent of all patent cooperation filings in 2007. In 2007, parties with Brazil as the country of origin filed only 375 patent applications in the USA; with Mexico as the country of origin only 212; with the Philippines, 81; with Jordan, 15; and with Morocco, 6. These data are from countries with strong universities and research capacity. Mexicans filed only 629 patent applications in Mexico, contrasting with 8689 applications by people with the USA as their country of origin. The Indian filings in the USA are impressive because of their growth over time, from 91 applications in 1995 to 2387 in 2007, but they are still small in absolute terms given the strength and size of Indian research institutions. Filings with the European patent office and the PCT by developing country parties are similarly low. Indian parties filed only 383 applications in 2007. See wipo_pat_appl_by_office_origin_table.xls.

9. The problem of technology access is rooted in the thicket of issues known as the "IP divide": low funding for endogenous research in developing countries, inadequate technology management infrastructure, low patenting by nationals, and consequent weak bargaining power in technology licensing and development collaboration negotiations. For a complex of reasons, many excellent research universities in developing countries are starved of resources. Developing countries that fund R&D often do not formalize IP ownership in their research results. While a few developing country firms have succeeded in entering the market for climate change technologies, developing country parties do not, as a general rule, own significant numbers of patents and do not document other forms of IP.

10. The IP divide has been discussed in Cannady and Iglesias-Vega (2007) and Cannady (2004). As of 2007, developing countries file less than 2 percent of patent applications with the WIPO PCT facility and LDCs file less than 0.02 percent. National filings directly in developing countries and LDCs show the IP divide as well: approximately 95 percent of patents filed directly in developing country national offices are filed by non-residents, and patents filed in poor and very poor countries are almost universally filed by non-nationals. African nationals from countries covered by ARIPO and OAPI file almost no patents in their own countries or in other countries. The causes for low patent ownership are various: lack of innovation infrastructure, low numbers of patent service professionals with skills in drafting patent applications, lack of awareness, absence of clear institutional policies concerning IP in research institutions, unmotivated national IP offices, restrictions on IP assertion in sponsored research contracts, low R&D investment, and low investment in primary through tertiary education. By contrast, most developed country governments and private companies invest heavily in R&D and innovation infrastructure in order to promote patenting and creation of IP portfolios as a technology strategy. The difference in investment and policy is the IP divide.

11. See Barton (2007), which presents the case that patent ownership in some clean technology domains is not heavily concentrated. It is difficult to isolate data on numerical levels of patenting in climate change technologies because it is a broad category and also because these technologies are synthetic.

12. See Shah (2009). Developing countries have correctly resisted this initiative as dangerous to their flexibility to manage their own IP systems and make decisions about patentability.

13. Note recent efforts to reduce translation fees by the European Patent Office (EPO). The London Agreement entered into force on 1 May 2008, and 14 European Patent Convention (EPC) member states have ratified the agreement. www.epo.org/topics/issues/london-agreement.html.

14. See Ryan (2002).

15. The Doha Declaration on TRIPS and Public Health states: "Each Member has the right to grant compulsory licenses and the freedom to determine the grounds upon which such licenses are granted." Subsequent discussions have dealt with the situation where a country that does not have manufacturing capacity wishes to invoke Article 31 and have products subject to patents manufactured in another country.

16. Article 4, Paragraph 20(b) of the FTA between the USA and Jordan. www.ustr.gov/trade-agreements/free-trade-agreements/jordan-fta/final-text.

17. See Harmon and Pear (2001).

18. See Ryan (2002).

19. Paice LLC v. Toyota Motor Corporation, E.D. Texas (2009)

20. 42 United States Code Sec. 4608. For good compendium of compulsory licensing laws in various countries see: www.cptech.org/ip/health/cl/recent-examples.html

21. For a useful listing of compulsory licensing cases, see www.cptech.org/ip/health/cl/recent-examples.html.

22. See, for example, the *WIPO Magazine* article advocating "access" to climate change technology through patent information, at www.wipo.int/patentscope/.

23. See www.wipo.int/patentscope/en/data/developing_countries.html.

24. See www.wipo.int/patentscope/. Note that developing countries that make their patent data easily searchable in international databases effectively place their technologies in the public domain if their citizens do not patent in developed nations.

25. See www.espacenet.com.

26. See www.uspto.gov and especially patft.uspto.gov/.

27. In theory, patent claims must be "enabling" – that is, they should show a person skilled in the art how to practise the invention. In some countries, as in the USA, the claims must disclosure the "best mode" of practising the invention. As a practical matter, enablement and best mode are often not sufficient to practise the invention in a technology product.

28. 35 United States Code (USC) Section 112. "The best mode requirement creates a statutory bargained-for-exchange by which a patentee obtains the right to exclude others from practicing the claimed invention for a certain time period, and the public receives knowledge of the preferred embodiments for practicing the claimed invention." Eli Lilly & Co. v. Barr Laboratories Inc., 251 F.3d 955, 963, 58 USPQ2d 1865, 1874 (Fed. Cir. 2001).

29. See, for example, *WIPO Magazine* (2009).

30. See Quint (2008).

31. See Merges (1999), p. 10.

32. See Anthony (2000).

33. In one case, Dell, Inc. was found to have agreed to a standard for Video Electronics Standards Association (VESA) for a local bus to transfer instructions between a computer's central processing unit (CPU) and its peripherals but later "ambushed" the standard by asserting its non-pooled patents against the unsuspecting pool members (Baer and Balto, 1999). In another situation, Intel's patent portfolio was found to enable it to force smaller companies to license to Intel their proprietary technologies. See Anthony (2000), footnote 32.

34. Boon Swan Foo, executive chairman of A*STAR Exploit Technologies.

35. Including the European Telecommunications Standards Institute, the Association of Radio Industries and Businesses/Telecommunication Technology Committee (ARIB/TTC) (Japan), the China Communications Standards Association, the Alliance for Telecommunications Industry Solutions (North America) and the Telecommunications Technology Association (South Korea). en.wikipedia.org/wiki/Open_Invention_Network

36. See www.openinventionnetwork.com/pressroom.php.

37. See www.openinventionnetwork.com/about.php.

38. See blogs.computerworld.com/microsoft_bambam_tomtom.

39. "Some observers fear the proliferation of these patent pools will result in oligopolies. The trade of key intellectual property between these groups is seen by some as akin to nations aligning themselves for their own benefit. It is quite possible that different groups could cooperate on strategy or even participate in formal or informal treaties. Actions like these might easily be construed as anti-competitive." See www.nerac.com/nerac_insights.php?category=articles&id=117.

40. "Patent pools that have been approved by the Department of Justice since the 1997 approval of the MPEG-2 Patent Pool have been implemented in a common manner. Features of these patent pools include: 1. A technology standard that is definite and well defined; 2. An evaluator/independent expert to determine which patents are essential to the implementation of the standard, thereby defining a group of essential patent holders; 3. A license drafted and approved by the essential patent holders that allows the technology to be licensed on a reasonable and non-discriminatory basis; 4. A patent pool administrator appointed by the essential patent holders to handle administrative tasks such as signing up licensees, collecting royalties from the licensees, and distributing the royalties to the essential patent holders; and 5. The essential patent holders retaining the right to license the patents outside of the patent pool." Comments regarding patent pool and standards by James J. Kulbaski. See www.ftc.gov/opp/intellect/020417jamesjkulbaski.pdf.

41. See www.gsk.com/research/patent-pool.htm.

42. See www.unitaid.eu/en/The-Medicines-Patent-Pool-Initiative.html.

43. See www.wbcsd.org/templates/TemplateWBCSD5/layout.asp?type=p&MenuId=MTU2Mg&do Open=1&ClickMenu=LeftMenu.

44. For a listing of mechanistic ideas for licensing arrangements, see Krattinger (2004).

45. For a persuasive critique of encouraged passivity and development, see Moyo (2009).

46. See Sarma (2008).

47. The classic example of this is the non-exclusive license strategy for the Cohen Boyer recombinant DNA patent owned by Stanford University and the University of California, which gave rise to the biotechnology industry in the USA.

48. See www.pipra.org.

49. See www.lesi.org/Article/Home.html.

50. See Berman (2003, 2006).

51. For a list of national IP or innovation strategies, see www.wipo.int/ip-development/en/strategies/national_ip_strategies.html.

52. See http://english.peopledaily.com.cn/200303/19/print20030319_113574.html.

53. For a list, see www.sipo.gov.cn/sipo_English/laws/whitepapers/.

54. See www.china.org.cn/english/China/208354.htm.

55. See www.chinaipr.gov.cn/policy/documents/238071.shtml.

56. See reports showing major gains for China at www.wipo.int/ipstats/en/statistics/patents/index.html and www.oecd.org/dataoecd/5/19/37569377.pdf.

57. See Wines (2009).

58. See Ubieta Gomez (2008).

59. See www.caribbeannetnews.com/cgi-script/csArticles/articles/000042/004293.htm.

60. See www.allbusiness.com/north-america/canada/563087-1.html.

61. See www.inforse.dk/s_e_news_art.php3?id=149.

62. The Colombian science and innovation agency Colciencias and the Instituto de Capacitation e Investigacion del Plastico y el Caucho launched the network (SECOPI Energy) in the framework of the Colombian National Policy for R&D and Innovation Promotion that was adopted by the government in 2008. See www.colciencias.gov.co/portalcol/downloads/archivosContenido/762.pdf.

63. See www.wipo.int/pressroom/en/articles/2007/article_0068.html.

64. See www.a-star.edu.sg/a_star/25-Exploit-Technologies.

65. See Kuji (2009).

66. See WIPO (2006).

67. This discount is already available for filings by small businesses and research institutions from anywhere in the world filing in the USA. 35 United States Codes (USC) §41(h)(1).

68. See Cannady (2004).

69. See the revised negotiating text from the Ad Hoc Working Group on Long-Term Cooperative Action (AWG-LCA) at its sixth session, FCCC/AWGLCA/2009/INF.1, 22 June 2009. http//:unfccc.int/resource/docs/2009/awglca6/eng/inf01.pdf.

70. Part 195 refers to a global database or "clearing house" on green production technologies. There is a mass of information on green production on the Internet in various forms. The challenge is in getting capital to implement and further develop these processes in developing countries.

71. See Ellison (1953).

72. Part 186 even refers to strengthening *developed* country climate change research. Then it refers to the importance of south–south and north–south collaboration. But the predicate for such deals is strengthening developing country research by massive funding and prioritizing.

73. Part 194 concerns a "technology information platform" and once again elevates patent information to a goal. This already exists in multiple forms and recreating it in a new form will only create jobs and revenues in developed countries as consultants prepare expensive IT projects and advance IT and digital rights management (DRM) platforms.

74. For example, Part 181 refers to a "Technology Action Plan". This can and probably should be done on a national and regional, not international, level. This is essentially a national innovation strategy. The recommendation could be that countries conduct an innovation or IP audit, write strategies with the express goal of national innovation and increasing opportunities for win–win international collaborations, and then get support from the United Nations (UN) and donors to complement their plans. An international plan cannot be meaningful because each country is different and climate change technology cannot be distributed on this kind of bureaucratic basis.

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