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Knowledge

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Acronyms and Initials

ARIPO	African Regional Industrial Property Organization
CGIAR	Consultative Group on International Agricultural Research
DFID	Department for International Development
ECDPM	European Centre for Development Policy Management
EPO	European Patent Office
EU	European Union
FAO	Food and Agriculture Organization
GATS	General Agreement on Trade and Services
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GEF	Global Environment Facility
GNP	gross national product
GPG	global public good
IAEA	International Atomic Energy Agency
ICTSD	International Centre for Trade and Sustainable Development
IDRC	International Development Research Centre
IMF	International Monetary Fund
IP	intellectual property
IPR	intellectual property right
MDG	Millennium Development Goal
NIH	National Institutes of Health

NSF	National Science Foundation
OAPI	African Intellectual Property Organization
OECD	Organisation for Economic Co-operation and Development
PPP	public-private partnership
QUNO	Quaker United Nations Office
R&D	research and development
TRIPS	Trade-Related Aspects of Intellectual Property Rights
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UPOV	Union for the Protection of New Varieties of Plants
USAID	US Agency for International Development
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Preface

In many respects, knowledge is a textbook example of a pure public good, replete with free-riders and under-supply. Most governments protect the production of knowledge through intellectual property laws and promote it directly by funding research in specific areas. The critical policy challenge is to ensure the right balance between private and public interests, weighing the benefits of incentives for knowledge producers against the interests of knowledge users.

The pursuit of the international public interest in intellectual property and common knowledge has followed distinct paths, focused on the particular cross-border and global issues at stake. For intellectual property, the long-standing focus has been on cross-border reciprocity in honouring patents, copyrights and trade marks protected under national laws through a series of treaties administered by the World Intellectual Property Organization (WIPO), reinforced by the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement of the World Trade Organization (WTO). For common knowledge, the focus has been on the free exchange of scientific research findings and results, in some cases supported by public funding, including through international research partnerships such as the Consultative Group on International Agricultural Research and the International AIDS Vaccine Initiative. Indeed, in each of the two areas, the interdependencies associated with globalization call for a more cooperative approach internationally than hitherto.

The strategies and partnerships the international community has adopted to oversee the critical aspects of the knowledge agenda have evolved in line with the changing world context. As for intellectual property protection, nations have long allowed inventors to recoup their innovation and product-development costs through temporary monopoly pricing, as an incentive to produce more ideas with wide benefits. The first actual patents have been traced to fifteenth-century Venice. The extension of such protection into the international domain dates back to the 1883 Paris Convention for the Protection of Industrial Property, which extended patent protections across the 14 signatory states. These beginnings ultimately led to WIPO's creation in 1970, with 180 member states, and its subsequent evolution into a specialized UN agency with a mandate to administer intellectual property matters. With the conclusion of the Uruguay Round and the signing of the TRIPS Agreement in 1994, intellectual property entered the global era. Along with these developments there has been a progressive widening of protectable matter, rapid expansion of requests for patents worldwide—at an average annual rate of more than 25 percent during the 1990s—and standardization of treatment across countries. Until the advent of TRIPS, these trends were almost exclusively the preserve of developed countries.

Parallel to this is the complementary system of common knowledge. This system includes the vast stock of knowledge in the public domain reflecting centuries of human endeavour; knowledge that is "graduating" from intellectual property protection with the expiration of patents and copyrights; new scientific findings from basic research for which intellectual property protection is not sought (such as the Human Genome Project); and open source software (such as the Linux model), research tools and databases for which protection is also voluntarily—and oftentimes quite purposefully—not sought. While intellectual property is typically produced by proprietary research, traditional science and open source software are based on the cooperative principle of freely exchanging results and materials. Both systems—intellectual property and common knowledge—are needed, but there is no neat formula indicating how much of one relative to the other is desirable. Over the past 20 years, the balance between the two kinds of systems has been tilting towards private intellectual property.

Four papers on knowledge were commissioned by the Secretariat of the International Task Force on Global Public Goods and are presented here. They follow the discussion outlined above: governments' and the

private sector's respective roles in knowledge production, both in developed and developing countries; the global/international institutional system to oversee the global public good agenda for knowledge; and the importance of sufficient capacity in individual (developing) countries to manage and absorb knowledge produced elsewhere.

Papers commissioned by the Secretariat of the International Task Force on Global Public Goods

John Barton has prepared two papers: "Knowledge" and "Scientific and Technical Information for Developing Nations." "Knowledge," the broader paper, reviews the role of government support and of intellectual property rights in encouraging the production of knowledge. In doing so the author discusses institutions that govern the production of knowledge, both at the level of the public and private sector, and at the international level. He then reviews the resources available for knowledge creation and identifies gaps that need to be filled.

Most of all, Barton emphasizes how closely related knowledge issues are to each of the other global public goods areas discussed by the Task Force. Therefore, his overall observation—that there is a need for greater expenditures on knowledge production—is broken down by global public good areas. Barton calls for patent and copyright reform, international scientific decision-making capability, a restatement of the need for governments to respect freedom of the press and freedom of access to information and capacity building and technical assistance efforts in the areas of communicable diseases and global commons, among other reforms.

In his second paper, "Scientific and Technical Information for Developing Nations," Barton reviews the status of knowledge production and dissemination in the developing nations by looking at three sectors: pharmaceutical, agricultural and environmental innovation. He concludes that although there are significant differences, there is a pattern of relatively limited research expenditure for the needs of the poorest in both the medical and agricultural sectors.

Having described ways to support the production and distribution of information for the benefit of developing countries, Barton recommends five tasks:

- Provide public goods for the poor in the poorest developing nations (medicines).

- Develop new public goods for the poor (medicines and seeds).
- Enable scientifically sophisticated developing nations to participate more fully in the world's industrial development process.
- Enable poorer nations to become scientifically sophisticated and to participate more effectively in their development.
- Press for two global systemic tasks: adopting a treaty that encourages the scientific research process and increasing the understanding of the cost-effectiveness of research.

Similarly to Barton's paper on knowledge, Keith Maskus's "Information as a Global Public Good" starts with a broad look at the topic. In the first analytical part, the essential characteristics of information as a global public good are discussed, including the nature of static and dynamic market failures in providing and disseminating it. Second, the paper discusses in some detail the policy of intellectual property rights, offering particular advice to developing countries in terms of setting their own intellectual property rights standards, consistent with international requirements.

The third section analyses the need for a lead agency in the area of information. Maskus points out that a centralized knowledge institution, which would be charged with developing and disseminating new knowledge on a global scale, would be unworkable. Instead, he argues, much can be improved with regards to the existing (specialized) institutions, including information gathering and sharing, policy coordination and performance evaluation. He does conclude, however, that none of the specialized institutions are well positioned to take on a central coordinating role. Maskus instead argues that the World Bank, given its analytical and professional expertise, its existing extensive work in information and development, its role in encouraging policy reform in areas that affect information sharing and its experience in policy coordination, would be the most likely location for such a role.

In "Capacities for Global Management of Intellectual Property: Mapping Out Global Initiatives and Opportunities for Improvement," Paul Engel and Sophie Houée look at the capacity-building dimension of knowledge. This topic was identified by both Barton and Maskus as a key policy priority going forward, and Engel and Houée take a comprehensive look at ongoing capacity-building efforts and priorities. Their starting points are questions like: What types of capacities are needed in developing countries to enable them to participate, and benefit fully,

from the international intellectual property regime? What efforts are currently undertaken to promote developing country participation? What is known about the adequacy and effectiveness of these efforts? What can be done to improve current capacity strategies?

A general observation they make is that the extent and coverage of capacity-building initiatives seem to reflect more the particular, short-term interests of donor countries and agencies, and less those of developing countries. The authors argue furthermore that any effort should focus on enhancing the capacity of developing countries not just to apply the intellectual property rights, but to actually draw concrete benefits from it. In doing so, the authors insist that global efforts need to improve the approach, scope, level of funding, coverage and depth of current initiatives. Engel and Houée make concrete recommendations how this can be achieved.

Knowledge

Chapter 1

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Knowledge is the ultimate public good—because of its basic properties of non-rivalry in consumption and the fact that is difficult to exclude others from knowing something—but knowledge can also become a private good by legal means, as by the definition of property rights. Moreover, knowledge is a global public good. People in each nation can benefit from scientific or technological knowledge developed in other nations.

As the basis of technological innovation, especially in biotechnology and in industry, knowledge is crucial to economic development—particularly in the developing world. Knowledge is also essential to the other global public goods being considered by the International Task Force on Global Public Goods.

This paper reviews the role of government support and of intellectual property rights in encouraging the production of knowledge. It discusses several important institutions and rules governing the production of knowledge for development and other global public goods and makes several recommendations after reviewing resource levels and identifying gaps.

Twentieth-century progress in economic and human development and reduction of poverty was to a large extent based on developing and disseminating knowledge. Striking examples include the discovery of antibiotics and new vaccines that improved health; the development of fertilizers, pesticides and new crop varieties that reduced food shortages; and increased access to education that enhanced economic productivity.[1] This is confirmed by the line of economic research exemplified by Solow,[2] showing that economic growth exceeds that predicted by growth in investment alone.

Knowledge is a complex good. It can take different forms: scientific or applied, non-commercial or commercial, codified or tacit. Often presented as the ultimate public good—because of its basic properties of non-rivalry in consumption and the fact that is difficult to exclude others from knowing something—knowledge can also become a private good by legal means, as by the definition of property rights.[3]

Moreover, knowledge is a global public good. People in each nation can benefit from scientific or technological knowledge developed in other nations. Knowledge also benefits subsequent generations. These characteristics underlie the scientific tradition of a global commons of knowledge.

As a basis for technological innovation, especially in biotechnology and in industry, knowledge is crucial to economic development—particularly in the developing world. Knowledge is also essential to the other global public goods being considered by the International Task Force on Global Public Goods: peace and security, trade regimes, financial stability, control of communicable diseases and sustainable management of natural commons. Thus, achieving peace and security requires that nations know about other nations' military capabilities. Achieving open trade regimes and financial stability require knowledge of economic and commercial statistics about both public and private sector actors. Controlling communicable diseases and sustainably managing natural commons require knowledge of epidemiological and environmental data as well as of the technologies needed to respond to disease and environmental degradation.

The past 20 years have witnessed four major trends in knowledge. First, there has been an enormous increase in the creation of knowledge—with the growth of research budgets and particularly of scientific research tools (such as automated gene sequencing and satellite-based earth sensing) that produce large quantities of data. Second, knowledge has become more important economically. It represents an increasingly important product, as in marketed information; an increasing share of competitive investment, in the information society; and an increasing share of even physical products, such as the software embedded in an automobile or aeroplane. Third, the increasing openness of borders to products and people and the development of transportation and communication (particularly digital information technologies) have created new global opportunities for accessing and disseminating knowledge. Fourth, the use of intellectual property rights to protect knowledge has restricted access to information and technologies. Knowledge is increasingly privatized and commercialized[4]—even knowledge developed

with public funding, as public institutions use intellectual property protection more often.

Although the first three trends are positive, views differ on whether the fourth trend is positive or negative, both for knowledge in general[5] and for specific subjects such as medicine and agriculture.[6] Many critics think privatization has gone too far in basic science, where the growth of intellectual property rights may have made it more difficult for researchers to build on one another's discoveries, thus slowing research.[7] Moreover, the practical workings of intellectual property systems are being seriously criticized,[8] and their implications for developing nations are far less positive than they might be.[9] At the same time, in the development of pharmaceuticals, where firms must invest heavily to conduct the clinical trials necessary before a product can be marketed, and perhaps in the development of genetically engineered agricultural products, the intellectual property system really has provided a major incentive to invest in research.

Strategy

In the absence of special arrangements, there is inadequate economic incentive to produce knowledge, because many of the benefits of the knowledge are likely to be unappropriable by those who invest in producing it. If a firm's research or data can be too readily copied, the firm will not invest in conducting the research or producing the data.

Society has responded to this problem in two ways. One way is by directly subsidizing the production of knowledge. Thus governments and foundations support research universities and fund research directly. Similarly, governments collect and publish important statistics such as those needed for economic analysis.

The second way is by establishing intellectual property rights such as patents, trade marks, copyrights, database protection, trade secrecy (or confidentiality) and certificates of origins. Of particular note is the emergence of physical means of protecting information, as in plants whose seeds are engineered to be unable to produce a follow-on crop, and computer programmes designed to prevent copying of copyrighted works. Such programmes are being supported by an emerging legal regime controlling "circumvention devices" (devices that might be used to defeat such protection). Such a regime might end up affecting not only access to copyrighted entertainment work, but also access to other

forms of work including computer programmes installed on mass-produced mechanical devices, such as printer cartridges and automobile on-board computers. The idea behind all these systems is to stimulate innovation by increasing the appropriability of the returns from innovative activity. These returns can repay the upfront investments by the titleholder in research and development and can also generate a profit.

An efficient knowledge management system must strike the right balance between protection and dissemination. For example, traditional science is based on a principle of freely exchanging scientific research results and materials: scientists build on one another's work, and the returns are in the form of academic recognition and prizes. In contrast, proprietary research builds on a principle of controlling the appropriation of knowledge: results are protected by intellectual property; exchange is only as agreed; and the returns are in the form of profits.[10] Both systems are needed. For very basic research, where the applications are unknown and unpredictable, the first system is likely to be better (which explains why basic research is typically supported by public funds). Where the market application is clear and heavy investment is involved, the second system is likely to be better (which explains why pharmaceutical research is typically supported through patents).

Balance is also needed in devising policy on antitrust and competition law in technology-intensive areas. To the extent that intellectual property is emphasized, prices will be higher and, ideally, investment in research greater, achieving goals of "dynamic efficiency"—that is, the development of new products. To the extent that competition is emphasized, prices will be lower and, ideally, consumer access greater, achieving goals of "static efficiency".[11] The need again is for an appropriate balance (for much of the last generation, the balance has been shifting towards intellectual property protection and away from antitrust).

Recognizing that overly strong intellectual property protection can hinder society's use of knowledge, nations have created many systems to ensure the transfer and spread of knowledge, even that protected by intellectual property rights. Thus, patents are for limited terms and are published. Copyright is subject to fair use or fair dealing limitations. Click-wrap and shrink-wrap licenses may be subject to public policy review. Some nations have special arrangements for the government to use patented inventions; others have procedures for compulsory licenses to ensure the availability of a technology.[12] Many have procedures for using patented inventions in research. Database protection may be complemented by protections for scientific access to the information.[13]

This basic intellectual property strategy is complemented by principles facilitating access to knowledge (as in freedom of speech and freedom of access to certain government information), principles restricting access to knowledge (as in government control of classified information or protection of individual privacy), ethical rules (such as those governing clinical trials and research using human cloning), agreements on using existing knowledge and sharing the benefits generated by its exploitation (as in the commercial exploitation of knowledge developed by indigenous communities)[14] and private arrangements keeping information available (as through patent pools and open-source computer programmes).

The process of making science-based judgements, as for climate change or possible long-term secondary effects of genetically modified organisms,[15] deserves special attention. Such judgements, traditionally made by experts, are now receiving increased public scrutiny from those who question the judgement or the impartiality of the experts. Special information is often needed for these judgements. Sometimes, as in studies of global climate change, the data are developed by publicly sponsored research and sometimes, as in evaluating the safety and efficacy of new pharmaceuticals, the private sector is required to develop the necessary data as a condition of marketing the product.

Institutions

Knowledge management involves public and private actors as well as governmental and non-governmental ones. In the public sector, the institutions managing knowledge production and dissemination are mostly national ones: patent offices, public research funding agencies and centres, census offices and government statistical offices. Among the key private sector actors are the research and development departments of firms and economic actors such as accountants and stock exchanges. These actors are supported by a panoply of supervisory institutions: ethical commissions reviewing research procedures, government agencies reviewing corporate disclosures, organizations setting accounting standards and national academies of science reviewing disputed questions of science-based policy. At the national level, the government typically provides the policy framework and coordinates these actors and institutions. Table 1.1 relates some of these institutions to examples of the global public goods being considered by this Task Force.

Table 1.1 **How government institutions relate to global public goods**

Global public goods	Actors	Types of knowledge and issues	Institutions	Rules	Gaps	Recommendations
Knowledge	Private	Technology; Patents	Internal research and technology transfer processes	Patent law	Research for developing nation needs	Patent and copyright reform
	National	Research support	Patent and copyright offices		Capability for science-based decision-making	Support for capacity-building Freedom of information
	Global	Technology transfer	WIPO; WTO CGIAR, research partnerships, WHO, FAO, etc. for specific kinds of technology	TRIPS Technology transfer principles	Support for global research Actual transfer of research products, such as pharmaceuticals	International scientific decision-making capability Special purpose research support agreements Reciprocity-based science access agreements
Security	Private					
	National	Intelligence Freedom of the press	Intelligence agencies	National security legislation Freedom of the press	Balanced information	Freedom of the press
	Global	Verification	IAEA and parallel organizations under chemical and biological treaties	IAEA and UN treaties and decisions	Investigation capability	Stronger IAEA and similar capabilities

(continues)

At the international level, the institutional framework for managing knowledge is even more fragmented. As an illustration, the intellectual property part of this framework involves the WTO's Council for Trade-Related Aspects of Intellectual Property Rights (TRIPS), the World Intellectual Property Organization (WIPO), the International Union for the Protection of New Varieties of Plants (UPOV) and others. Technical assistance for developing countries is provided by WIPO, the European Patent Office (EPO), the World Bank, the United Nations Development Programme (UNDP) and the United Nations Conference on Trade and Development (UNCTAD). For the peace and security global

Table 1.1 **How government institutions relate to global public goods (continued)**

Global Public Goods	Actors	Types of knowledge and issues	Institutions	Rules	Gaps	Recommendations
Trade	Private					
	National	Statistics	Trade ministries	Data collection	Statistics in poorer nations	Technical assistance
	Global	Statistics	World Bank, IMF, WTO	WTO	Continuous economic analysis and review of impact of TRIPS	Publish new series Do more analytic work Independent audit of statistics
Finance	Private	Accounting	Accounting firms and their professional organizations	Accounting rules	Accounting in less transparent nations	Stronger accounting standards (for public entities as well)
	National	Statistics and accounting enforcement	Securities regulators, census offices, commercial and banking regulators	Census and data rules Freedom of information	National data collection and analysis resources	Stronger accounting enforcement (and for public entities as well)
	Global	International statistics	World Bank, IMF, WTO, International Organization of Securities Commissions	IMF, WTO, Group of Eight	Regularly published global statistics	Publish more global statistics Independent audit of statistics Technical assistance

(continues)

public goods, there are international verification institutions such as the International Atomic Energy Agency (IAEA) and the criminal law data exchange activity of Interpol. For the economics-related goods, there are international accounting and stock exchange organizations. Organizations such as the IMF, the World Bank and the WTO publish important statistics. For fundamental science as well as disease control and the global commons, important roles in scientific data exchange and technology transfer roles are played by institutions such as the WHO and the World Meteorological Organization. Some of these also assist in making science-based policy judgements, as exemplified by the Intergovernmental Panel on Climate Change.

New management systems have emerged for inventions deriving from government-supported research. Under the Bayh-Dole legislation in the

Table 1.1 **How government institutions relate to global public goods (continued)**

Global Public Goods	Actors	Types of knowledge and issues	Institutions	Rules	Gaps	Recommendations
Disease	Private	Technology	Private research groups	Patent law	Research and products for developing nation needs	Differential pricing
	National	Epidemiological and monitoring data	Health research ministries Public health ministries	Public health law	Monitoring systems	Treaty changes
	Global	Technology transfer and assistance	WHO, Global Fund for AIDS, Tuberculosis and Malaria, World Bank	WHO international health regulations	Research and products for developing nation needs	Stronger international research capabilities
Commons	Private					
	National	Research studies Collection of statistics	Research ministries Environmental ministries	Environmental legislation Freedom of information	Decision-making capability	Technical assistance Data sharing obligations
	Global	Decision-making Technology transfer	UNEP, GEF	Environmental treaties	International integration of statistics Decision-making capability	Special purpose funding International academy of sciences

United States, US universities are encouraged to patent the results of government-sponsored research and to license the inventions for commercialization. That has led to the creation of university offices of technology licensing. It has strengthened links between the public and private sectors and has certainly facilitated commercialization in some cases. However, it has also significantly increased the legal complexity of carrying out research, and some fear that it will encourage researchers to ignore social needs in favour of what is commercializable. The financial returns to universities have been substantial in a very few cases; however, they are typically small. On average, universities realize only about $1 of royalty income for each $100 of sponsored research they carry out. Nevertheless, the system is being emulated throughout the world.[16]

Another notable institutional innovation is the emergence of research partnerships between government entities or between public and private institutions. These partnerships focus on specific research areas. Examples include the International AIDS Vaccine Initiative, which is

paralleled by many other collaborations in the medical sector, and the Consultative Group on International Agricultural Research (CGIAR), which coordinates a variety of agricultural research institutions throughout the world. The CGIAR has produced important new crop varieties. It is too early to tell whether the more recent medical organizations will be equally effective.[17]

Scientific publishing is also changing. At one time, scientific and engineering literature was available only in paper form and was very expensive, especially for university libraries in developing nations. Almost all this material is now available online and is, therefore, in theory, accessible to anyone with an adequate telecommunications link. Nevertheless, a number of journals maintain high prices, even for online material. This has led to pressure for creating free online journals, such as *PloS* (Public Library of Science) *Biology*, and for a norm that all online journals should be available free in the poorer developing nations after a time delay, such as six months after posting.

Rules

At the national level, the policies and rules related to scientific and technological knowledge include those focused on intellectual property, many already noted. More broadly, there are fundamental requirements of freedom of the press, and there are government rules on access to and management of government data, such as the UK crown copyright and the US freedom of information acts.

There are also non-intellectual property rules, to encourage the private sector to develop new data. Thus the product approval rules for pharmaceuticals compel firms to produce the necessary safety and efficacy data. In addition, regulatory regimes based on "the best available technology" may create incentives for the development of new technology. And there are tax-based incentives for research and development.

International regulation related to knowledge mainly focuses on intellectual property. One can distinguish three kinds of treaties. Standard-setting treaties, such as TRIPS and a variety of earlier treaties such as the Paris and Berne conventions, define basic standards of protection. Some facilitate international registering of intellectual property rights. Classification treaties harmonize intellectual property information into manageable classifications.[18] Most such agreements are administered by WIPO, which is also developing the Substantive Patent Law Treaty to

become the umbrella agreement for patents. In addition, there are many bilateral and regional intellectual property agreements and several trade agreements include provisions governing intellectual property standards (the North American Free Trade Agreement is an example).

Fewer rules govern the international dissemination of knowledge protected by intellectual property rights. There was a major debate in the 1970s over principles of technology transfer to developing nations, but the debate did not lead to universally agreed principles. Instead, now, there are national and international rules requiring technology transfer to developing nations in specific contexts, particularly in environmental treaties such as the Convention on Biodiversity (although it is unlikely that the more abstract of these requirements have been effective). Moreover, the 1995 TRIPS Agreement has been moderated through the 2001 Doha Declaration on TRIPS and Public Health and the 2003 decision implementing that declaration, which have created a presumption in favour of differential pricing for pharmaceuticals. This means that, normally, such products will be available at lower prices in the developing world than in the developed world, even while on patent, so that the developed world patients (and their healthcare providers) pay the costs of research.

The most important international rules on knowledge other than intellectual property are the requirement for freedom of the press expressed in international human rights documents and the requirement for access to public (and sometimes private) information included in certain environmental agreements, such as the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters. At the less formal level, there are scientific journal rules requiring public access to the data and materials needed to verify the conclusions of a scientific article and special scientific norms such as the 1996 Bermuda Agreement for access to genomic data.

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) also has a role, in the words of its constitution, to "[m]aintain, increase and diffuse knowledge: . . . [by] encouraging cooperation among the nations in all branches of intellectual activity." This agency plays a particularly important role in collecting statistics and often cooperates with international organizations focused on more specific scientific issues in defining principles for making decisions under uncertainty[19] and establishing ethical rules such as those for research on human subjects or with national genetic resources.

Resources

The knowledge generation system focuses primarily on the needs of developed nations. Three points are especially important. First, the research itself is focused on the needs of the wealthy. Thus, only a small fraction of the worldwide expenditure on health research and development is devoted to the major health problems of the majority of the world's population.[20] Of the 1,233 drugs that reached the global market between 1975 and 1997, only 13 were for tropical infectious diseases that primarily affect the poor.[21] Second, the private sector plays only a limited role in the poorer nations. In the developed world research resources derive much more from the private sector than the public one: roughly 68% of all US research was done by the private sector in 2000, up from about 55% in 1990.[22] In contrast, research for or in the developing world is supported much more substantially by the public sector.[23] Third, public sector research capabilities are found primarily in a few relatively sophisticated countries, such as Brazil, China, India and a number of middle-income countries, rather than in the poorest.

The trend in international technology transfer reflects an increasing role for the private sector and a more static role for the public sector. The private sector has certainly been transferring a large amount of technology through foreign direct investment, albeit into a relatively small group of nations and with a recent slowdown (reflecting the world economy).[24] Public sector efforts have been more static. Although it is estimated to have rebounded (in nominal terms) about 8% in 2003,[25] the budget of CGIAR declined in real terms at a rate of about 1.8% during most of the 1990s.[26] Yet, this is one of the most cost-effective expenditures of public funds ever made.[27] (It must be recognized, however, that middle-income developing nations are investing heavily in this area.) In medicine, public expenditures are quite substantial but far short of the need.[28] The support for capacity-building programmes for developing nations is relatively constant,[29] yet it is small compared with the need.[30] And the role of international education is likely to be limited by slow-downs in granting visas, deriving from terrorism concerns.

In security-related knowledge, there has been a recent increase in both Interpol and IAEA budgets, but until then the IAEA budget had not increased significantly since the mid-1980s.[31] Information related to other global public goods is increasingly available. Certainly, the national and international organizations providing economic and scientific statistics continue to produce a large amount of data and are making it

more and more readily available online. The level of expenditures on accounting in private firms is almost certainly increasing; whether it actually produces more data is another question. The key concerns here are that some nations are unable to afford to collect good data, and the data from the firms and the public sector entities of some nations are much more credible than are those from other nations.

Assessment

In science and technology-oriented information, there are four gaps. First, the intellectual property system as designed is not optimal for achieving its purposes, even from a developing world perspective. There is a serious argument that intellectual property rights are overly strong and in some situations may harm research; this point reflects concerns stated above and shared even by many economists sympathetic to the general concept of intellectual property.[32] To respond to these concerns requires such actions in the patent area as limiting patents on fundamental discoveries and abstract principles, raising the standards for non-obviousness or inventive step to reduce the number of patents on minor improvements and easing the experimental use of patented technologies. In other sectors European legislation on database protection should be eliminated, anti-circumvention legislation narrowed and the availability of scientific journals and databases facilitated. These actions are mainly relevant to national governments in developed countries; they can be expected to help the progress of technology in those countries, and thus indirectly help the progress of technology in developing countries.

Second, the intellectual property system is not successfully serving the needs of the developing world. Here the issues are the costs of access to the patent system, which severely restrict its use by developing nation scientists, and the costs of patented technologies, particularly of pharmaceuticals. Moreover, because the developing world market is so small, the patent system does not provide the incentive needed for large-scale research for the developing world. It may help private sector agricultural research but not larger scale pharmaceutical development. For pharmaceuticals, the world is moving towards a differential pricing system—but, despite that evolution, access to pharmaceuticals is still inadequate in much of the world.

Third, there is inadequate support for research specific to developing nation needs. One response is to find new political mechanisms to encourage donor support of public sector research. Another is to find new ways to encourage private sector research. Thus, there have been proposals to give pharmaceutical companies extended product exclusivity in the developed world in return for creating products for the developing world; this seems politically unlikely and simply converts the subsidy from one provided directly by developed world taxpayers to one provided by developed world healthcare funders. Or the subsidy can be made through a tax break, which leaves it less visible. Or, in a quite different mechanism, donors can promise to procure products needed specifically for the developing world, with the promised procurements large enough and credible enough to elicit private sector investment.[33] The task is to find the approach most likely to induce donor nation support.

Fourth, there are important issues of technology transfer in the private sector, affecting mainly middle-income developing nations. Foreign direct investment in a group of such nations has been increasing and is bringing technology into that group of nations. The global strengthening of the intellectual property system, however, is making it harder for indigenous firms in developing nations to access technology (now protected in their nations) and markets (where products are often protected).[34] This is an issue very different from the pricing concerns of the 1970s involving access to technology for import substitution. Antitrust arrangements, in both the developed and the developing nations, may be helpful but the effectiveness of this approach still needs analysis. Further, even in some middle-income nations, the indigenous private sector is relatively uninterested in investing in research. Sometimes there are macroeconomic reasons—based, perhaps, on high interest rates—but often there is also a culture that might be changed. Again, analysis is needed.

For the poorer nations, the key science and technology problems are the lack of adequate funding of public sector research and the question of how to take off scientifically in the way that a few developing nations have. For almost all lower income nations, access to higher education at home is seriously limited. Although some 400,000 developing world students are studying at the university level in the developed world, those students come in large part from relatively few nations, mainly in Asia.[35]

For peace and security, the key information gaps are probably twofold. First, the world community lacks access to information about programmes for trade in arms and for developing weapons of mass destruction—that

is, the kind of data sought by military strategists and IAEA inspectors. The balance between national sovereignty and transparency is probably weighted too much against transparency. The other problem is a lack of good public knowledge and understanding about the cultures and concerns of other nations. Here the key issues are the freedom of the press and the quality of the media.

For trade regimes, the information gaps are few. The WTO and most national governments publish statistics and probably provide an accurate picture, save for the flow of prohibited substances such as drugs and for distortions of information about prices where such information might reveal corruption. It would be valuable to have stronger estimates of whether and how the WTO regime—including TRIPS and the trade in services regime, and perhaps the privatizations of the past decade—have helped or hurt developing nations.

For financial stability, the accounts published by developed nations and by private firms in those nations are probably adequate, although the quality of the accounting process can certainly be substantially improved, for both public and private entities. What is lacking, as demonstrated by the 1997 Asian crisis, is similar transparency in other economies. There have been global efforts to increase that transparency since 1997; whether they are adequate is unclear.

It is also desirable to create global statistics, such as a "gross global international product" or savings or employment rates, to provide the basis for a more global perspective in making national and international economic policy. Some of these data are available, yet they are hard to find, and it is even harder to find credible series. Moreover, problems of currency fluctuations and the appropriate way to integrate indexes from different nations (as well as the questionable accuracy of national data) make it difficult to calculate such statistics with any reliability. Yet they are themselves a global public good.

For the control of communicable diseases, there are two big knowledge gaps. One is the lack of medical technology for treating and curing such diseases, which reflects a failure of support for the research (as for a vaccine for HIV strains prevalent in Africa), as well as a failure to provide adequate funds to purchase drugs (even in light of the moves towards differential pricing). The other is the continued failure of nations to provide timely information about emerging diseases within their borders, a problem that derives both from inadequate resources for monitoring and from national sensitivity.

For the sustainable management of natural commons, there are three gaps. They are typical of areas involving science-based regulation. One is the need for more underlying science—there is certainly not enough information about, for example, the effects of the increased use of nitrogen or the dynamics of food chains in the ocean. Second is a need for better institutions for evaluating data and disseminating information to the public. This is exemplified by the political disputes over global warming and genetically modified organisms. Third is a need for more development of adaptive technologies. The fact that alternate refrigerants were available to replace those banned under the ozone layer treaty made adaptation to that treaty relatively easy. Rarely will alternatives be that available.

Recommendations

Implicit in these assessments are a variety of recommendations (see table 1.1). Almost all require greater expenditures by the private sector, national public sectors or the international public sector. Because such funding is difficult to acquire, it is important to package the recommendations in ways that increase their likelihood of gaining political support. Moreover, such recommendations are likely to be negotiated in the context of specific organizations and ministries—hence it is useful to think in terms of several packages.

Freedom of the press and freedom of access to government information are not only an important part of the peace and security package, but are also likely to contribute to many other public goods, such as those involving economics, the global commons and disease control. Hence, this paper recommends a restatement of the need for governments to respect freedom of the press together with a new statement of the need for governments to create and respect strong freedom of information arrangements for their internal activities and for data in military, economic and environmental areas. This could be supported by an international treaty and by technical assistance.

For peace and security, the key information need is for increased transparency about certain specific national activities. This is almost certainly best negotiated in the context of security, the IAEA, weapons of mass destruction and terrorism, completely separate from the development-oriented scientific and technological context. Technical

assistance in this area is provided through the UN, the IAEA or bilateral organizations.

For the two economic goods, the recommendations are similar. At the national level, stronger accounting and financial transparency procedures are recommended for both private firms and public entities. Requirements for greater national openness about public procurements and resource sales would be particularly valuable. These efforts might be supported by international assistance in building such procedures in nations lacking them. The World Bank and the IMF are presumably the entities best able to provide such assistance. And such assistance certainly should be supported by an increased effort by the relevant international organizations—such as the World Bank, the IMF, the WTO and the OECD, as well as the UN institutions—not only to continue publishing statistics and analytic work, but to expand this work, improve its quality and also publish regular series of global macro-economic indicators.

The knowledge recommendations related to disease control and sustainability are best combined with those for the scientific and technological issues that are the primary focus of this paper. The one clear exception is that of national transparency for epidemiological data about communicable diseases, which is best negotiated in the context of global public health, rather than technology. The WHO and UNEP are specifically responsible for technology transfer in these areas.

Turning to scientific and technical knowledge, the essential task is education. Ultimately, all knowledge derives from human insight. The opportunities available to bright students in the developing world are dreadfully inadequate and vary from area to area. There is an especial need in Africa.

It is essential to improve the global intellectual property regime.[36] One step is to ensure acceptance of the specific reforms of intellectual property law discussed above. These reforms apply to patent law, Internet and copyright law, database protection law and anti-circumvention law. They are primarily matters for national governments (and the European Union), but WIPO and the WTO are also involved because some reform options may be affected by international agreements and ongoing harmonization negotiations. At this global level it is desirable that the WTO, as part of its trade statistics function, evaluate the actual working of TRIPS.[37]

The private sector needs to pay more attention to international technology transfer. Three issues need more study before it is possible to make solid recommendations. One is whether the existing intellec-

tual property system significantly harms the emergence of indigenous enterprise in the developing world and, if so, what response is appropriate and feasible. The response certainly falls in the area of patents and antitrust, but it is difficult to define. Second is how national governments in the developing world can encourage national firms to invest more substantially in research. India and Taiwan (province of China) have certainly succeeded, but they are very much exceptions. Third is the problem of increasing the number of developing nations in which foreign direct investment and technology transfer is concentrated (currently about 10) to a larger group of nations and ultimately the world.

Increased funding of public sector science and technology for developing countries is essential. It is needed in the medical, agricultural and environmental areas. Donor nations have long been supporting these areas inadequately despite every neutral panel's evaluation that more support is needed. The job is one of political packaging. Two approaches can be used. One is to emphasize the importance of the need. This is the approach taken by the Commission on Macroeconomics and Health. There have also been proposals for a research treaty that would, in essence, bind nations to commit resources to research needs for developing nations.[38] In a sense, this is the Global Fund to Fight AIDS, Tuberculosis and Malaria, with a greater concentration on research than on product procurement and supply. This kind of approach is likely to work best for specific and dramatic needs, such as HIV in Africa, where the developed world taxpayer is likely to sympathize.

The other approach is to emphasize the mutual benefits of increased funding. Thus, in medicine, it is important to emphasize that public health is a global public good and that the developed world taxpayer benefits from health elsewhere in the world. For broader kinds of technology, it is best to emphasize the reciprocity underlying the global commons of knowledge and the fact that scientists in each nation rely on scientists in other nations. This would encourage nations to reciprocally remove restrictions on the flow of information just as they have reciprocally removed tariff restrictions.[39] This is likely to work better for science and public sector technology, where it might, for example, help reduce restrictions on grants from national agencies to foreign entities. This kind of system is probably best negotiated in the WTO or UNESCO.

It would be very useful to appoint a body such as UNESCO or the UN Statistics Division as an international anchor institution to review and report on the development and transfer of knowledge relevant to global public goods and to developing nations. The body should be

charged with maintaining key statistics, identifying gaps, making suggestions for coordinating the various institutions involved, as well as helping create global positions on cross-cutting issues, such as ethical rules for research and rules for making decisions under uncertainty. Making the scientific data series more detailed—assembling for the world the kind of data that the National Science Foundation and the Organisation for Economic Co-operation and Development assemble for the United States and the other developed nations—is an excellent goal.

For some purposes, such a political group must be supplemented by an institution able to give scientific advice independent of political input. This is a function that national academies of science traditionally carry out. Strengthening the inchoate international collaboration among national academies of science and of such groups as the Third World Academy of Sciences is essential. Ideally, these groups would provide the scientific advisory groups for negotiations on priority global public goods (on the model of the Intergovernmental Panel on Climate Change or the Commission for Macroeconomics and Health). It is essential both that final decisions incorporate political concerns and that political decision-makers receive scientific advice that is public and, as much as possible, does not reflect political considerations.

Finally, there should be independent efforts, similar to those undertaken by the US National Academy of Sciences Committee on National Statistics and the UK Statistics Commission, to ensure the quality of national and international statistics in all areas.

Notes

1. See, for instance, UNDP (2001).
2. See Solow (1957).
3. For details on definition, see Stiglitz (1999).
4. See, among others, David (2001).
5. See, for instance, David (2002).
6. See Eisenberg and Nelson (2002).
7. See The Royal Society (2003).
8. See United States Federal Trade Commission (2003).
9. See Commission on Intellectual Property Rights (2002).
10. See Esanu and Uhlir (2003).
11. See, for instance, Correa (2003).
12. See Correa (1999).

13. See, for instance, Commission on Physical Sciences, Mathematics and Applications (1999).
14. See, among others, Okediji (2001).
15. See, for instance, Henry (2003).
16. See Commission on Intellectual Property Rights (2002).
17. See, for instance, Bill & Melinda Gates Foundation (2002).
18. See Commission on Intellectual Property Rights (2002), p. 156.
19. For example, the precautionary principle of the Cartagena Protocol on transboundary movement of living modified organisms.
20. See Global Forum for Health Research (2002).
21. See Global Forum for Health Research (2002).
22. See US National Science Foundation (2003).
23. See UNESCO Institute for Statistics, series on the percentage distribution of gross domestic expenditures by source of funds, available at www.uis.unesco.org/TEMPLATE/html/sc_consult.html. For most of the developing nations listed, the public support (including higher education support) for research is more than 60%. The comparable numbers for France, Germany, Sweden, the United Kingdom and the United States are almost all less than 40%.
24. See United Nations Conference on Trade and Development (2003).
25. See Consultative Group on International Agricultural Research (2003).
26. See Operations Evaluation Department of the World Bank (2003).
27. See Alston and others (2000).
28. See Global Forum for Health Research (2002) and Commission on Macroeconomics and Health (2001).
29. Although they have been increasing in the past several years, the total technical assistance efforts as measured by the OECD, deflated by the US GNP deflator (used because the US share is large and the numbers are summed in dollars) are essentially the same as they were in the early 1990s. See OECD (2003).
30. For example, an estimated $1.5 million per developing country is needed to comprehensively upgrade intellectual property rights regimes. See Commission on Intellectual Property Rights (2002), p. 150.
31. IAEA Press Release. 18 July 2003.
32. See Royal Academy of Science (2003); US Federal Trade Commission (2003); Commission on Intellectual Property Rights (2002).
33. See Kremer (2001).
34. See Barton (2003).

35. Data for 1999, calculated from US Department of Commerce. 2002. "Indicators on Internationalization and Trade of Post-secondary Education," presented at OECD/US Forum on Trade in Educational Services, 23–24 May 2002, available at www.oecd.org/document/14/0,2340,en_2649_34549_1833550_1_1_1_1,00.html.
36. For a review of possible mechanisms and policy options, see the sources listed in note 34 as well as Reichman (2003).
37. See Barton (2001).
38. See, for example, Love (2003).
39. See Barton (2003).

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Scientific and Technical Information for Developing Nations

Chapter 2

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This paper is prepared to assist the International Task Force on Global Public Goods in its consideration of knowledge as a global public good. It concentrates on scientific and technical information needed by developing nations. The first part reviews the status of knowledge production and dissemination, beginning with three case studies (pharmaceutical, agricultural and environmental innovation), and concluding with a discussion of broader technologies, including industrial technology. Although there are significant differences from sector to sector and several areas in which the world is doing reasonably well—such as agricultural technology for the middle-income developing nations—there is a pattern of relatively limited research expenditure for the needs of the poorest in both the medical and the agricultural sectors. And industrial research is concentrated in the developed world.

The second part describes ways to support the production and distribution of information for the benefit of developing nations. They include use of the intellectual property system, various forms of open-source technology development, proposals to change the intellectual property system more fundamentally, a variety of subsidy structures and treaties that might help improve access to technology for developing nations. In general, the intellectual property system and subsidies in the form of donor-sponsored research are likely to be essential to meet the most important needs for scientific and technological research.

The third part summarizes what is known about the cost-effectiveness of information development and transfer as a method of economic development. It reveals very high rates of return, particularly in agricultural and preventive medical research.

The fourth part suggests priorities and responses to critiques. In particular, it suggests that the Task Force concentrate on recommendations to accomplish five tasks:

- *Provide public goods, such as medicines, for the poor in the poorest developing nations.*
- *Develop new public goods, such as medicines and seeds, for the poor in nations that for many years will be unable to participate significantly in developing these goods for themselves.*
- *Enable scientifically sophisticated developing nations to participate more fully in the world's industrial development process.*
- *Enable poorer nations to become scientifically sophisticated and to participate more effectively in their development.*
- *Accomplish at least two global systemic tasks: a treaty to encourage the scientific research process and understanding the cost-effectiveness of research better.*

These five tasks are presented in more detail in the annexes, together with thoughts on institutional ways to accomplish them and very crude estimates of their financial costs and benefits.

This analysis begins with a study of three specific areas. Thereafter, it turns to broader data on the balance between research oriented towards the developed world and that oriented towards the developing world. In looking at the three specific areas, it is essential to remember that there are three separate (although sometimes linked) problems: first, providing developing nations with the benefits of existing technology (as in access to drugs); second, providing them with new technology (as in research on drugs for diseases endemic to the developing world); and third, providing them with the ability to develop and use technology themselves (as in research facilities in the developing world).

The pharmaceutical area

Although it is difficult to find solid data about the early (pre-1940 or even pre-1980) history of the pharmaceutical industry in the developing world, it is clear that there was such an industry in some more advanced nations, as exemplified by the Oswaldo Cruz Institute in Brazil, founded in 1900 to produce a vaccine against plague, and Vacsera in Egypt, whose roots go back to 1897. Traditional medical technologies were also used widely in many nations.

During the twentieth century, however, multinational developed world firms came to dominate pharmaceutical research. It has been hard to find overall data, but there are certainly several plausible underlying factors. First, stronger product approval requirements have significantly

increased the cost of developing new drugs, particularly since the passage of the 1962 amendments to the US Food and Drug Administration statutes requiring a demonstration of efficacy in addition to the long-required safety demonstration. There are similar laws in many other nations, and there is also a stronger sense now that clinical trials are required and must be carried out ethically—again raising development costs. Second, the increased scientific complexity of drug development has given the advantage to the industries of those nations that have large markets and maintain large-scale public sector research programmes on which the private sector can build. Third, there has undoubtedly been a rise in the level at which economies of scale in production set in, so that globally integrated firms have an advantage over small national firms. And last, there is no question that the spread of pharmaceutical patents to developing nations has contributed to the power of the large multinational firms. Patent laws in developing nations began to change with the rise in the 1980s of the Washington Consensus, emphasizing development through private sector incentives. The culmination of the change was the 1995 Agreement on Trade-Related Intellectual Property Rights (TRIPS). Passage of these stronger patent laws may have enabled and encouraged multinational firms to displace or absorb local firms that had been producing generic equivalents for their national markets.[1]

The result: there is relatively little drug research other than that supported by the major government agencies of the developed world, such as the US National Institutes of Health (NIH), or by the group of pharmaceutical firms centred in the North Atlantic nations and, to some extent, Japan. Both the public and private sector agencies of these nations concentrate, understandably, on the diseases of these nations, because they represent the only market large enough, in general, to allow recovery of research costs. In the more scientifically sophisticated developing nations, there are also capable public sector firms, as in Brazil, and private sector firms, as in India. These firms sometimes collaborate with the global pharmaceutical firms, and they are, in some cases, very sophisticated in the production of high-quality, inexpensive copies of global firms' products. In producing such products, they are limited to only those made for diseases of developed nations. This "generic niche," created by the absence of patent protection in India, shrank in 2005 with India's application of TRIPS standards to its patent system. Some Indian firms are expecting to convert into research-based firms—but are likely to look to the same developed world markets as do the existing global firms.

This industry structure explains the high prices for pharmaceuticals in some developing nations and the small amount of research done for products needed primarily or exclusively in such nations. The price and research issues deserve separate consideration. The price/access issue, so strongly debated recently, depends on the product and on the nation. By excluding pharmaceutical products from patent protection, India has long provided access to relatively low-cost products for its consumers, and exported some to other nations. This is uncommon. In many regions, such as Sub-Saharan Africa, life-saving products have not been available at affordable prices. This is partly a matter of patents, partly a matter of the inefficiency of the local distribution system and partly a matter of the frequent weakness of the broader medical infrastructure. But it has led to a political outcry against patents and ultimately to the 2001 Doha and 2003 Cancun agreements to interpret TRIPS in a way that recognizes public health realities. And firms have been more willing to contribute drugs on a free or deeply subsidized basis to the most acutely affected developing nations. But it must be recognized that, because of Doha and Cancun, private firms will have even less interest in investing in research that may help developing nations. Much more serious (because that research incentive is already very weak) is this issue: although the agreements may solve most of the legal problems in making drugs available, they certainly do not solve the economic problems. Even with drug donations and generic imports from India, only about one in six of the patients in developing nations who need antiretrovirals receive them.[2] Hence there remains a need for subsidy, as in the Global Fund to Fight AIDS, Tuberculosis and Malaria and the World Health Organization's (WHO's) "3 by 5" initiative, to provide antiretrovirals to 3 million people in the developing world by 2005.

The research picture remains very skewed. The Global Forum for Health Research is the source of the "10/90 gap"—the estimate that only 10% of global health research resources are spent on diseases that affect 90% of the world. The forum has been working to produce more precise measures, including the fact that only 13 of the 1,233 drugs that reached the global market between 1975 and 1997 were for tropical diseases. They have assembled numbers for 1998 health R&D funding, totalling $73.5 billion. Of this, 3% is public funding in low- and middle-income countries, and 8% is private non-profit funding. They do not have numbers on the overall percentage oriented towards diseases of the developing world, but they do have an estimate for 1996 of the investments for drugs to treat malaria, acute lower respiratory infec-

tions, diarrhoea, tuberculosis and road traffic injuries. These diseases and injuries total roughly 23.5% of the world disease burden (as measured in DALYs, disability-adjusted life years), but they receive only 0.36% of the total investment in health research.[3] Médecins sans Frontières cites a pharmaceutical industry survey showing that of 137 medicines for infectious diseases in the pipeline in 2000, one mentioned sleeping sickness, one mentioned malaria, and none mentioned tuberculosis or leishmaniasis.[4] And Pharmaceutical Research and Manufacturers of America's (PhRMA) statistics show that, of the 17.3% of pharmaceutical research performed abroad by its (US) member companies, only 0.8% is performed outside Europe or Japan.[5]

Recognizing the low level of research on the medical needs of developing nations, the global community has already begun trying to find new ways to support such research. Thus the NIH and a number of public sector entities and foundations have long supported research on various tropical diseases. For 1999, for example, the last year for which data appear to be available, the NIH spent $272 million on international activities.[6] Although this is small compared with the institutes' $15-billion budget at the time, consider that some of the institutes' other work, such as that on HIV, provides indirect benefit to developing nations. And the fact that military services and travellers from the developed world want products for some of these diseases provides a commercial market that can elicit private sector investment and provide spill-over benefits to developing nations. More recently, public-private partnerships (PPPs) have blossomed. PPPs are typically non-profit entities with a significant amount of donor funding that they use in pursuit of vaccines or pharmaceuticals for particular diseases of developing nations. They do so by supporting research at universities or in the private sector, under contracts that give them the right to use the technology deriving from the research on favourable terms in developing nations. Ideally, as they show progress towards a product, they will be able to raise the larger sums of money needed for the later stages of research, including clinical trials (which they may, of course, contract out under appropriate terms). As will be detailed below, such partnerships have received more than $1.1 billion in commitments.[7]

These entities face intellectual property issues different from those that raised so much debate at Doha. For these entities, the problem of research tool patenting may be particularly severe. Research tools are inventions or discoveries, some made in universities and some in industry, that are useful in developing new products. Examples include animals

that have been genetically modified to serve as models for experimentation on a particular disease, the sequences of genes that are relevant to a particular disease, the precise molecular shape of a protein that may be a useful target for a new drug or the sequence and shape of that part of a pathogen that may be a useful target for a vaccine. In many cases, these tools are patented, and the patent may make it very difficult to do research on the subject in the developed world without infringing. The scope of the problem is still in dispute.[8]

Thus, in summary, the poorest developing nations are receiving far fewer medicines per capita than the developed nations. Private sector research is growing rapidly but is not focusing on developing nation needs. Subsidies are needed both for products and for research; their sizes are probably increasing in both cases, but not nearly enough. And privatization is affecting research tools, but the significance of the effect is in question.

The agricultural area

The situation in the agricultural sector is very different.[9] First, the cost of innovation is significantly lower—breeding and seed production have traditionally been conducted in organizations comparable in size to an ordinary farm, albeit with additional employees. Even biotechnology-based breeding, which is significantly more expensive than conventional breeding and may require field trials to evaluate the safety of a variety (along with its yield and resistance to pathogens), is far less expensive than drug development. Second, the need to modify products to suit local conditions is much greater. Medical products developed for a particular disease in one nation will often be effective in other nations. In contrast, the variety of differences in climate, soil, growing season and pathogens makes an agricultural variety developed for one region unlikely to be optimal in another.

As a result, for traditional (not genetically engineered) breeding, the global centralization of research and product development found in medicine is not duplicated in agriculture. Historically, most plant breeding was carried out in the public sector, typically in ministries of agriculture or affiliated universities. The varieties were made available to farmers with essentially no charge for the benefits of the breeding. This process has been disseminated to, for example, the national agricultural research institute in Brazil (EMBRAPA), probably the largest agricultural research establishment in the world. And the process has been in-

ternationalized by the efforts of foundations and donor nations to create globally funded research institutions in the developing world such as the International Maize and Wheat Improvement Center (CIMMYT) outside Mexico City and the International Center for Rice Research in the Philippines. These institutions, now under the auspices of the Consultative Group on International Agricultural Research (CGIAR), created the Green Revolution, which enormously increased yields—particularly in South and East Asia during the last third of the twentieth century. The institutions continue to develop new varieties, often in the form of material used for further breeding in national agricultural development programmes. These varieties are then multiplied in either the public or the private sector (depending on the individual nation) and distributed to farmers. But national research programmes are now far more important, at least in magnitude, than those of the CGIAR, which represents less than 5% of the public sector agricultural research done for developing nations.[10]

There have been two sources of privatization, one associated with traditional breeding and one with genetic engineering–based breeding. Private sector traditional breeding for grains emerged for hybrid corn in the United States in the middle of the twentieth century. Hybrids provide a form of proprietary protection, because the seeds produced by the crop do not breed true to type and are therefore effectively unusable. The industry produced enormous increases in yields in the United States. Similar private industries evolved in Europe and, on both continents, for horticultural products such as fruits and ornamentals. During the last third of the twentieth century, these firms were encouraged as well by the widespread adoption of plant breeders' rights (also known as plant variety protection), a special purpose form of intellectual property protection. These firms have extended their development and marketing to many developing nations, particularly those of Latin America and South and East Asia, and they bring new varieties to these regions.

The second source of privatization is the development of genetic engineering as a way to produce varieties. Although the underlying research was carried out in the public sector in the developed world, the private sector emerged during the 1990s as the leading locus of research. This is partly because private sector expenditure levels grew while public sector expenditures stagnated. It is partly also because the private sector obtained a large number of patents (and in some cases, exclusive licenses to patents gained in the public sector) and thus made it impossible for the public sector to commercialize new products with-

out permission (which was sometimes not granted). Moreover, driven in part by the need to settle a series of patent conflicts in the 1990s, the public sector firms merged extensively to become a global oligopoly of about five firms, able to bar others from entering the lucrative markets in the developed world. This globally concentrated industry has been quite successful in its sales to several developing nations, particularly Argentina, but has faced difficulty in some because of the fear of genetic engineering or of being unable to export products to Europe (where genetically engineered products have been difficult to market). Based on a sample of annual reports, the industry's research levels have been static recently, presumably because of its fears of the political response to genetic engineering.

The result is the following investments, for 1995:

Public sector research for developed nations	$10.2 billion
Public sector research for developing nations	$11.5 billion
Private sector research for developed nations	$10.8 billion
Private sector research for developing nations	$0.7 billion[11]

Perhaps surprisingly, there is more public sector research for developing nations than for developed nations. And the trend is favourable to the developing nations—their public sector research nearly tripled in the 1976–95 period, while that of the developed nations increased by a factor of only about half.[12] But this pattern hides some problems. First, relatively little research is done for the needs of the poorest, particularly for those in Sub-Saharan Africa. This is partly because the ecosystems of that continent are so diverse that research focused on any particular region presents an unattractive cost-benefit ratio compared with research focused on the much larger and more populated ecosystems of other regions. It is also partly because of the weakness of the national research systems, which do not have the strength of those in Brazil, China or India. Thus agricultural yields in Africa have been dropping. Since 1981 agricultural production per capita has risen by 80% in developing Asia, and by more than 20% in Latin America, but fallen by more than 10% in Sub-Saharan Africa.[13]

The other problems are posed by patents and by the status of the international public sector system, particularly the CGIAR. Most seriously, the public budgets available in this sector are diminishing. International agricultural research has been evaluated as one of the most effective of all forms of development investment, yet donor support is

shrinking, and the overall inflation-adjusted budget has remained static or declined since 1990.[14] A less important issue may be that there are patents on many of the important tools used in genetically engineered crop varieties. These patents are a barrier to research in the developed world and to research on export crops for major markets. Some are in force in major developing nations (Brazil, China) as well as in the developed world. But they are less likely to be in force in the least developed countries. Moreover, patent holders have indicated a willingness to license rights to these patents relatively freely for Sub-Saharan Africa, provided the technologies are distributed through an intermediary responsible for ensuring proper use of those technologies that may be sensitive from a biosafety perspective. Such an intermediary is being set up in the form of the African Agricultural Technology Foundation.

The environmental area

The environmental area is unique in that on this issue the developed world has typically been the petitioner in international negotiations and has therefore offered concessions to the developing world to obtain its participation. This means that many environmental agreements include provisions in which the developed world commits to provide technology to developing nations to help them comply with their environmental commitments. For example, the United Nations Convention on Biological Diversity requires parties "to provide and/or facilitate access for and transfer to other contracting parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment" (article 16). These commitments are probably ineffective—developed nations tend to argue that they are already providing technology, and it is difficult to demonstrate that there is "additionality", that is, additional technology transferred compared with what was happening earlier.

But in at least one specific case—the Montreal Protocol, designed to protect the ozone layer—a more formal system has been set up, designed specifically to provide developing nations with access to industrial technologies needed to facilitate reduction of emissions that harm the ozone layer. For example, the international donor community provides more than $100 million per year to help nations comply with the treaty (say, by supporting the purchase of new equipment).[15] This is a form of technology transfer that is real and does transfer the

product of the technology and provide the desired environmental benefit. But it may also benefit the developed world firm that produces the equipment. In increasing order of long-term economic significance, the international system might instead help build a factory to make the equipment locally (presumably with a royalty to the developed-world firm providing the technology) or help create a laboratory in the developing world in which environmentally safe equipment might be discovered (and possibly patented). The long-term industrial structure implications of the three strategies (direct subsidy, local capacity-building and local innovation support) differ radically.

There is also a much broader environmental assistance mechanism, the Global Environment Facility or GEF, created by a joint effort of the World Bank, the UNEP and the UNDP.[16] It contributes roughly $500 million per year to environmental activities in specified areas. Although some of these funds go to non-technological (but desirable) purposes such as creating biodiversity reserves, some have also supported building solar thermal power plants in several nations, as well as plants for other forms of renewable energy development, such as photovoltaic and wind-derived. Thus they also have genuinely transferred technology.

Other areas

In most of these areas, governments have played a major and very specific role in encouraging research, and international technology transfer, to a significant extent, takes place within the public sector. But there is also an important type of technology transfer that takes place mainly through the private sector and is exemplified by many industrial technologies.

Thinking about this area changed radically with the development of the Washington Consensus during the 1980s. Before then, much of the thinking was dominated by the dependency theorists, who emphasized the high cost of technology in the context of import substitution. The goal was to build a local factory to supply the national market. When this factory was provided by a multinational industry, the overall costs—in the form of profits, royalties, management fees and artificial transfer prices on imported components—were often enormous. It was therefore thought essential to regulate the process, typically by controlling some prices and prohibiting the use of specific contractual clauses. Although Japan used such regulation very effectively in building its technology-based industry, there is debate among economists

about the role of such regulation,[17] and certainly few other nations were as successful.

The Washington Consensus emphasized free markets and privatization. Nations began to dismantle the technology transfer offices they had built. The goal now was to remove barriers that discouraged foreign direct investment. This change occurred along with the change towards open markets and international trade. The multinational investors presumably now had an incentive to bring in the technology needed to serve the world market. Doing so avoided the inefficiencies implicit in the development of smaller scale import substitution, often based on outdated technologies. This new world of free trade (sometimes built on some degree of local protection, as in several East Asian nations) has been quite successful for nations such as Brazil, Korea, Malaysia, Mexico, Singapore and Taiwan (province of China) and is now proving successful for China.[18]

Several of these nations are now not only receiving technology for particular industrial facilities, but also hosting multinational research centers, to take advantage of local human resources. Among those cited in a recent US National Science Foundation (NSF) study are Singapore ($548 million of US overseas research investment in 2000), Israel ($527 million), China ($506 million), Hong Kong ($341 million), Mexico ($305 million), Brazil ($250 million), Malaysia ($214 million) and Taiwan (province of China) ($143 million).[19] These numbers can be compared with total overseas research investment of $19.8 billion, $12.9 billion of it in Europe. At the same time, the numbers are growing rapidly, increasing in some developing nations by factors of 10 or more since 1994. (The NSF does not give numbers for India; clearly India is such a beneficiary as well, particularly in information technology.)

But there are at least two deficiencies in the model. First, it has bypassed many nations, particularly in Sub-Saharan Africa. The process simply has not worked for nations that have weak or corrupt governments, poor educational systems and inadequate legal assurances. In fact high-technology exports of low-income and lower middle-income nations actually shrank during the period from 1970 to 2001, while those of high-income nations rose by a factor of roughly 29.[20] Thus new models are needed for these poorer nations.

Second, the global free trade model, especially now that TRIPS is in force, may favour multinational firms at the expense of local indigenous firms. The possibility of entering global markets may be limited by the privatization associated with existing intellectual property rights,

except as multinationals are willing to supply those technologies, either through licensing or through foreign direct investment.[21] And royalties themselves may be a barrier; the World Bank estimates that the increases in patent royalties that nations must pay as a result of TRIPS are, in the most dramatic cases (which will, of course, be the technologically strongest developing nations), $530 million for Brazil, $903 million for India, $2,550 million for Mexico, $5,121 million for China and $15,333 million for Korea.[22] Moreover, with strong intellectual property regimes in place, multinationals are likely to be more interested in setting up subsidiaries or in purchasing local firms. This is more important for small nations than for large ones, such as China and India, that offer a substantial internal market and are more likely to develop strong indigenous firms, as Japan and Korea did. For the smaller nations, the multinationals are the major source of technology.

To encourage technology transfer (and ideally indigenous development), it is essential to have a national capability. Technological understanding is needed in order to acquire technology.[23] Therefore nations have built scientific and technological research organizations and have also encouraged advanced education.

The variety of such research organizations is enormous. Most of the more successful nations have a group of organizations, generally all supported by the government (some using donor funds), some oriented towards basic research and some towards particular technological areas. In a few places, such as Korea and Taiwan (province of China), there are research institutions devoted to industrial technologies, typically designed to help encourage the development of indigenous firms. Some of these nations have overcome the barriers that traditionally exist between academia and industry. For many nations there is still a risk that the researchers trained in the developing world (sometimes with studies in the developed world) will seek their future either in industry or in the scientific community in the developed world.

Only a few developing nations, such as Korea, have created substantial scientific institutions. The numbers are summarized in a World Bank study:

> The differences in capacity between the scientifically advanced countries of the OECD and the poorer countries of the developing world are stark. OECD countries spend more annually on R&D than the value of total economic output of 61 of the world's lowest income countries ($500 billion versus $464 billion

in 1998). Again compared with low-income countries, OECD countries have 12 times the per capita number of scientists and engineers working in R&D and publish 25 times more scientific journal articles per capita. In the OECD the ratio of patents filed by non-residents to those filed by residents is 3.3 to 1, while in low-income countries it is 690 to 1.[24]

The study estimates elsewhere that the total donor funding for developing world R&D capacity is on the order of $1.2 billion.[25] This is roughly 0.3% of the amount of R&D in the developed world—far less on a per capita basis.

As suggested by the fact that the World Bank compares developed nation research numbers with developing nation economic output rather than research, solid numbers for developing nation research are difficult to find. The NSF uses a few numbers it finds credible and notes that seven countries represent 85% of the estimated $603 billion in R&D by the OECD nations for 2000. Among the non-OECD nations for which it gives numbers are China at $50.3 billion, Russia at $10.6 billion, Israel at $5.6 billion, Brazil at $4.6 billion, Argentina at $1.3 billion, Chile at $0.4 billion and Colombia at $0.2 billion. The distribution is highly skewed, and the numbers for poorer nations are clearly extremely low.[26]

But the basis for participating in the world technological society is not simply a matter of research; it is also a matter of education and access to knowledge. Here the numbers are equally discouraging. A simple calculation from UNESCO numbers shows that 1.5% of the population of the developed world is enrolled in tertiary education; the corresponding number for the developing world is 0.09%.[27] The UNDP *World Development Report* finds so few data for the poorest nations that it presents no summaries in this area. Access to data is also difficult in many developing nations, because of limited access to the Internet and to scientific journals. Although there are few statistics on the topic (and the Internet world is changing rapidly), one survey found that 56% of medical institutions in nations with a GNP below $1,000 have no subscriptions to journals.[28]

Possible institutional innovations and policy options

There are many ways to adapt or improve the system to encourage more effective transfer of technology to developing nations. Five op-

tions in the intellectual property area are presented first, followed by alternatives to intellectual property and then various forms of subsidy. The final options are international agreements designed to facilitate technology transfer. Because the variety of approaches is so great, some approaches might fit under several headings.

Living with the existing intellectual property system

First, the intellectual property system is sometimes helpful to developing nations—and not just by providing an incentive in the developed world to create products that may also be useful in the developing world (the basic pattern for pharmaceuticals). There are also cases where patent incentives are beneficial in the developing world. An example in advanced science is agricultural biotechnology where, at least in middle-income and scientifically sophisticated developing nations, the patent system may encourage innovation. It is also possible that modified utility patent or "petty patent" systems may encourage local mechanical innovation such as for agricultural implements, but the effectiveness of such systems is subject to debate.[29]

Second, it is sometimes possible to encourage holders of intellectual property to make it available free or on reasonable terms. They may do so because they may not have a commercial market or because they anticipate public relations benefits. Thus, agricultural biotechnology firms are likely to be willing to make their technologies available for use in the poorest developing nations and for products, such as cassava, that have no global commercial market. This is the basic strategy underlying the Rockefeller Foundation's creation of the African Agricultural Technology Foundation, which will make a variety of new technologies available for use in research for African subsistence farmers.[30] It is also the strategy implicit in free or reduced-rate subscriptions to online scientific journals (already happening extensively),[31] and in proposed "humanitarian exception" clauses. Under such clauses, when intellectual property holders license technology, they protect the possibility of free or low-cost access to technologies for the benefit of developing nations only.[32] This approach has been applied in PIPRA (Public-Sector Intellectual Property Resource for Agriculture) as a way that universities can ensure that their technological developments are available for developing nations.[33] This point (as well as the desire to obtain public relations benefits) also underlies the drug donations made by pharmaceutical firms to Sub-Saharan Africa. Note that these strategies work only for

markets that have little commercial potential, and only where it is possible to separate the markets so that the intellectual property holder can protect its commercial markets. In some cases, it may be most feasible to use a pool of intellectual property rights, licensed together, possibly with safeguards (such as assurance of proper treatment from a biosafety perspective as in the African Agricultural Technology Foundation) that may be important to the intellectual property rights holders.

Third, it is possible to maintain a multiple-price structure, even over the opposition of the intellectual property rights holder. This is the tiered pricing concept frequently envisioned for drug access. The lower price in the developing world is maintained through price control (assuming the patent holder is willing to supply the technology or product at that price) or through compulsory licensing and production by an alternate supplier, if necessary. (Normally the threat of a compulsory license is enough to induce the lower price.)

Fourth, specific principles can be incorporated in a nation's intellectual property law to help maintain the benefits and minimize the costs of such a law. In patent law, these principles include a high standard of non-obviousness or inventive step that prevents patenting of trivial inventions, a subject matter or utility standard that prevents patenting of fundamental discoveries, a review procedure that helps prevent the issuance of mistaken patents and an experimental use exception that permits the use of inventions for certain experimental purposes. In copyright law, these principles include fair use (or, in the United Kingdom, fair dealing) provisions that permit certain uses, such as certain copying for the convenience of researchers. In both computer programme copyright and trade secrecy/confidential information law, these principles include a broad freedom to reverse engineer an article in order to understand how it works and improve on it. All these principles are mainstream doctrines. Many (but not all) legal systems provide such rights, and such rights are supported by many (but not all) scholars. Farther out of the mainstream (and inconsistent with TRIPS) are proposals for liability-based systems (as opposed to injunction-based systems) in which the infringer must pay a royalty but cannot be enjoined from using the invention.[34]

Fifth, it is essential to build in the appropriate antitrust/competition law counterbalances to misuse of intellectual property. There is at least a significant risk that the effect of intellectual property law is to strengthen existing global oligopolies and to slow the entrance into the world market of new firms from the more advanced developing nations.

Although this is not a concern for the poorest nations, it is one for the middle-income nations and for all who benefit from more rapid development and diffusion of technology. The intellectual property and antitrust issues are complex, and it is hard to define a balance confidently, but, in at least some cases, antitrust law may help prevent abuses of intellectual property rights while respecting incentives to innovate.

Open-source systems alongside the intellectual property system

Another approach is to use open-source systems, groups of researchers among whom the intellectual property system is deliberately forgone, for either ideological or practical reasons. The most straightforward example is the emergence of public scientific journals, such as *PloS* (from the Public Library of Science), in which a group of scientists have created a new form of freely available scientific literature. Another example is Linux and the GNU license, in which software is made available in a way that provides easy access to the source code so that errors and problems can be found readily by the public community of users. This is followed, in another context, by the Creative Commons pattern of facilitating desired degrees of openness in copyright.[35] And, in still another context, the Center for the Application of Molecular Biology to International Agriculture (CAMBIA) is attempting to assemble packages of technology that avoid the restrictions imposed by corporate patent holders.

Such arrangements, including pools and patterns of licensing technology freely, may also be created to facilitate research. There are important examples in genomics where, under the Bermuda Principles,[36] certain genomic information will not be patented. This direction is facilitated by the NIH's rules on access to research tools. In essence, under some circumstances, these rules require universities to refrain from exercising the rights to patent research tools that they may have under the Bayh-Dole Act, instead making the tools freely available for research.[37] Another example is the SNP (single nucleotide polymorphism) Consortium, in which several pharmaceutical firms, together with the Wellcome Trust, make access to these genetic markers freely available.[38]

These systems must survive alongside the existing intellectual property system, and it is thus necessary to structure the open-source world in a way that protects it from those who would interfere with intellectual property rights. For Linux the GNU license requires that software built on the open-source programme be subject to the same openness

and license. This is sometimes described as a viral procedure or as "copyleft"; it ensures that advances in the technology remain in the public domain. Similar strategies have been used elsewhere, as in the mozilla.org license of the Netscape source code.[39] This approach, however, is not necessarily effective against efforts to assert patent rights on the technology or against rights based on early development agreements. Thus the SCO Group's lawsuits against Linux users are based on early development agreements; if successful, they might undercut the openness of Linux. The open-source techniques will not open up a protected technology; rather they can create a new open-source space in the middle of protected technologies—and that open-source space may or may not prove big enough for effective use.

Changing the intellectual property system more fundamentally

A third general approach is to attempt to change the intellectual property system much more fundamentally. An example is put forward by Jean Lanjouw, who would effectively require patent holders to choose between protection in the developed world and protection in the developing world. She recently put forward this idea in the form of a "foreign filing license", under which developed world patent protection would be contingent on the holder's willingness to offer a license to developing nations (which would presumably, for pharmaceuticals, create an opportunity for generic manufacturers in the developing nations).[40] Although there is certainly room for debate on this point, it is not clear that the approach is politically feasible.

Other approaches attempt to provide fundamentally different incentives, such as prizes, as exemplified by the British Parliament's 1714 announcement of a prize for a device to assist in measuring longitude. A similar approach is being implemented for the benefit of African agriculture in a new proposal by Will Masters of Columbia University.[41] It will be interesting to see what types of innovations are evoked. Note that, under some circumstances, these approaches (and direct contracts oriented to technology development) may, in economic theory, be more efficient than the patent system.[42]

Subsidy structures

Intellectual property systems provide inadequate incentive for many forms of research, and it is wise therefore simply to subsidize such re-

search. The obvious examples are direct public sector support for basic research and for agricultural and medical research. The CGIAR is a prime example, as is the research supported by the NIH and the Bill & Melinda Gates Foundation on tropical diseases.

Subsidies have been given most often for basic research, leaving the private sector to develop applications and products. However, where the government is a primary customer, as in the military, it may contract for R&D and thus subsidize research directly, when it is conducted, or later, through a price that reflects the earlier expenditures on research. There is no reason that this model cannot be applied in other contexts (versions of it have already been used in some public health contexts). Moreover, public sector entities can exercise their buying power very effectively. The UNICEF Supply Division, for example, can get a lower price on entire lots of vaccines by providing predictability and a guarantee of payment. It is certainly possible that it, or an agency such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, can not only acquire products more cheaply but also use its buying power in a way that encourages research. Doing so might also aggregate demand in a way that could encourage additional private investment in research or construction of production facilities. Such use of buying power is central to the work of Michael Kremer, who has proposed a "pull mechanism" based on a vaccine purchase fund.[43]

In some cases, a subsidy is disguised or decentralized. For example, the US Orphan Drug Act provides a period of product exclusivity different from that of the patent system to create an incentive to develop new products—for the first seven years of production, patients (and those who pay for their healthcare), in essence, pay for the costs of research. The Act has been quite successful, resulting in many new drugs. Similar proposals have been made to encourage development of products for developing nations, with, for example, an extended period of exclusivity for a major product on the developed world market as the incentive to develop new products for developing nations. (This "roving exclusivity" model seems so arbitrary in the way it imposes costs that it is unlikely to be politically acceptable.) Proposals that seem much more feasible include tax benefits to firms that provide vaccines to developing nations (as in President Clinton's proposal for a Millennium Vaccine Initiative), carry out research in developing nations, contribute technologies to research groups working on issues pertinent to developing nations or train graduates from developing nations.[44]

A subsidy may also be provided through a programme of cooperation between the non-profit and profit sectors, as exemplified in the PPPs created to develop pharmaceuticals for developing nation needs. These programmes are an extension of cooperative programmes such as the Onchocerciasis Control Initiative, established in 1974, which was funded in part by nations and international organizations and in part by a private firm that supplied medicines.[45] In such programmes, public or foundation funds provide a subsidy to an entity that organizes and procures research on a particular disease. Some of the research may be conducted by the private sector, operating under contract and sometimes willing to donate certain assets, such as candidate compounds. The intellectual property provisions of the relevant agreements are designed to protect access to the technologies for the benefit of developing nations. Some 25 such partnerships are carrying out research; the 16 partnerships analysed in a recent study have a total of $1.1 billion in funding commitments (overall, not annually).[46] An analysis of five of them, for which commitments total $401 million, estimated that the cumulative resources needed to carry out their plans to 2007 would be $2,467 million, leaving an implied shortfall on the order of $2 billion.[47] Although some lines of research will almost certainly be abandoned, the PPPs will need substantial additional funding to deliver products to patients in the developing world.

Economic theory suggests that these direct subsidy approaches are generally the wisest. They do, however, require the subsidy granters to make the key allocation decisions, and thus they lack the benefit of decentralized decision-making found in the patent system. Moreover, subsidies are difficult to support politically for the long term. As noted above, funding for the CGIAR has stagnated over the past decade; funding for basic medical research in the United States has grown rapidly over the past decade, but growth is slowing down under pressure from the Iraq war expenses. The recent growth in concern about diseases of developing nations and in funding for both products and research results in large part from the efforts of the Bill & Melinda Gates Foundation. How long this concern will continue is not clear, nor is it clear how much of the overall activity represents new resources.

Supporting treaty patterns

Several treaties encourage technology transfer, including the TRIPS Agreement, which provides in article 66.2 that:

> Developed country Members shall provide incentives to enterprises and institutions in their territories for purpose of promoting and encouraging technology transfer to least developed country Members in order to enable them to create a sound and viable technological base.

These treaties appear rarely to contribute to actual new technology transfer.[48] Note that the TRIPS article is restricted to least developed countries.

More recent and more detailed proposals fall into two categories. One category attempts to encourage particular levels of research of benefit to developing nations, based, for example, on letting developing nations substitute research for patent costs.[49] Such techniques are likely to be most successful for issues such as HIV or global climate change, in which the need for and benefits of cooperative research are most clear. (Note that such research is sometimes encouraged and coordinated without a treaty, as in the CGIAR.) Another category attempts to regulate in a way that indirectly benefits developing nations. Thus Arzsberger and others (2004) propose an international framework of rules designed to encourage access to scientific data and report on an OECD Ministerial Declaration supporting such a concept.[50] Reichman and Uhlir (2003) would accomplish a similar result by parallel action by national governments to maintain freedom of access to data developed under government funding.[51] Barton and Maskus (2004), building on the concept of a scientific commons,[52] would seek to harness the benefits of reciprocity to ensure sharing of scientific data and possibly of technology.[53] These approaches are likely to be most successful for basic science and more difficult to achieve for applied technologies.

Cost-benefit analyses

Most cost-benefit analyses have been of particular forms of research. There have been many studies of the effectiveness of investment in agricultural research, for example, typically showing high double-digit returns. Some 292 published studies analysed in a recent meta-analysis show a median rate of return of 48% per year and an average rate of return of 100% for research. For extension services, which help transfer research results to the farmer, the corresponding numbers are 62.9% and 85%.[54] And in most cases, the poor benefit. One report summarizes,

"The public sector national agricultural research systems, with the assistance of the CGIAR, can justly claim to have reduced poverty, probably more than any other single initiative."[55]

There have been fewer studies of the benefits of medical research in developing nations, and the cost-effectiveness of medical technologies is likely to depend heavily on the particular technology. It should be remembered that there have been arguments in the developed world that new technologies have driven increased healthcare expenses,[56] together with counter-arguments that the technologies are generally beneficial if the additional years of life deriving from them are taken into account.[57] These points may be consistent if the high end-of-life costs are driving the increased cost of medical care in the developed world. Moreover, as people live longer (as a result of the new technologies), they need further care. Thus some new technologies—particularly end-of-life technologies, advanced diagnostic technologies and drugs that imitate existing drugs—may not offer a high cost-benefit ratio in the developing nations. In contrast, there are success stories with incredible rates of return—the cost of eradicating smallpox was $315 million over 12 years, with an estimated saving per year of more than $360 million, or a rate of return of more than 100%.[58] And the economic costs of disease are substantial; one estimate suggests that nations that fail to control malaria have a 1.6% lower growth rate.[59] A recent careful review of the literature questioned this number but concluded that the benefits of using existing technology more fully would place HIV control and malaria control among the top economically desirable interventions (in any sector) in the developing world.[60] Hence, certain medical research for developing nations is likely beneficial but should focus on preventive efforts (such as vaccines) in which the cost-benefit analysis is likely to be very positive.

The benefits of industrial research are essentially as dramatic as those of agricultural research. There have been several solid studies of industrial research in the developed world, some suggesting social returns on the order of 25% to 75% depending on the measure used,[61] others suggesting more modest rates in the 15% to 30% range.[62] These numbers are based primarily on experience in developed nations—whether the same rates will apply in developing nations is unclear. With TRIPS, it has become significantly more difficult for developing nation firms to enter the global marketplace, except by cooperating with developed nation firms.[63] It seems intuitive that a share of the research expenditures should go to technology acquisition, on the hypothesis that much of

the technology needed in a developing nation is already available from developed nation research. And it is certainly anecdotally true that developing nation firms invest little in R&D and have poor contact with national research entities.[64] In some cases, these problems are certainly matters of high interest rates and short time horizons. In a few cases, the problem may be a lack of intellectual property protection. But the most likely explanatory factor in many cases is the lack of a research-based industrial culture. Ways to encourage such a culture (such as through internships in technology companies in developed nations) deserve attention. A key educational goal in developing nations might be to help provide engineers and scientists with the ability to access and apply technology from abroad and from the public sector.

The benefits for education are somewhat lower. A leading World Bank analysis of several recent studies estimates social returns on the order of 8% to 25% for primary education, with the higher numbers occurring in poorer nations.[65] For tertiary education the numbers across nations converge significantly at 8% to 12%, again with the higher returns in poorer nations. For basic welfare enhancement in developing nations it is thus normally concluded that primary education is crucial, especially for girls. But the importance of tertiary education is growing significantly as the world moves to a more knowledge-based economy.[66]

Conclusions

The analysis and studies presented above make it clear that the world would benefit from an increased emphasis on the public goods of science and technology for developing nations. In particular, the analysis suggests that the Task Force concentrate on recommendations to accomplish five tasks.

The first task is to provide existing public goods, such as medicines, for the poor in the poorest developing nations. The Doha and Cancun arrangements have essentially removed the intellectual property barriers to doing this, but they have not solved the problem of creating an industrial structure that is funded and able to supply the needed products. Solving this problem will require public funding, along the lines of the Global Fund to Fight AIDS, Tuberculosis and Malaria.

The second task is to develop new public goods, such as medicines and seeds, for the poor in nations that will for many years be unable to participate significantly in developing these goods for themselves. This

is a public sector issue. Based on what is presented above about the cost-effectiveness of such R&D and the various mechanisms available, the emphasis should be on public sector R&D (such as that conducted by the CGIAR and the medical PPPs) focused on the agricultural needs of the poorest developing nations and the infectious diseases found primarily in developing nations. The intellectual property system is not helpful in supporting this research, and legal changes may be useful to solve the problem of research-tool patents that prevent development of new products. But the key task is allocating public funding in forms such as PPPs, prizes and perhaps even new institutions, such as an "international NIH" oriented to the medical needs of the poorest nations.

The third task is to enable scientifically sophisticated developing nations to participate more fully in the world's industrial development process. This is an issue of antitrust, trade and investment policy.

The fourth task is to enable poorer nations to become scientifically sophisticated and to participate more effectively in their own development. This is a governance and capacity-building issue. Development of a strategy for the third and fourth tasks is now being seriously considered by donors.[67] It may well be encouraged by a stronger commitment to standards of education and of government budgeting.

The fifth task deals with the global systemic issues. A treaty might be desirable to encourage the scientific research process, either a treaty on developing research specifically for the medical and agricultural technology needs of the poorest nations or a treaty of the type suggested by Barton and Maskus. And it is essential, especially in the medical and industrial sectors, to understand the cost-effectiveness of research better and to create institutional mechanisms to regularly re-evaluate the focus of international public sector support for scientific research that is oriented to the needs of developing nations and global public goods.

In presenting its recommendations, the Task Force might consider the reasons why the economically and socially desirable level of funding for science and technology has been difficult to maintain politically. The reasons may include the following:

The fact that the benefits, though substantial as measured in cost-effectiveness or effective rate of return, sometimes occur well in the future, so that expenditures with a more immediate benefit tend to take priority. Here the right response may be to emphasize the actual benefits and perhaps to organize regional or global institutions designed to encourage contribution and thereby decrease free-riding.

The fear in developed nations of creating new industrial competitors in developing nations. The response is to note that the global publicly funded programmes will certainly emphasize the poorer nations, which represent a minimal threat. The middle-income nations, which represent more of an economic threat, are in a position to invest more of their own resources. In addition it may be possible to emphasize a global Keynesian argument that growth in developing nations will benefit developed nations by expanding markets. This point, of course, requires economic analysis and testing.

The risk that expenditures on higher education in developing nations will lead not to increased research on issues important to the developing world, but rather to brain drain or emphasis on issues important to the developed world. The response is to help developing nations' research and educational institutions build better bridges to their national industrial and public sectors.

Annex: Details of the five recommended tasks

Task 1: Provide existing public goods to the poorest nations.

The first task is to provide existing public goods, such as medicines, for the poor in the poorest developing nations. The Doha and Cancun arrangements have essentially removed the intellectual property barriers but have not solved the problem of creating an industrial structure that is funded and is able to supply the needed products. The focus should be on drugs, particularly for HIV, tuberculosis and malaria, and particularly for the poorest nations such as those of Sub-Saharan Africa. It is important to determine the best mechanisms among alternatives such as buying products at concessional rates from existing suppliers or creating new public or private manufacturing systems (under compulsory license, if necessary).

The international institutions most able to assist in choosing among these mechanisms are the WHO, the Pan American Health Organization, the World Bank and the Global Fund to Fight AIDS, Tuberculosis and Malaria. The Global Fund is probably the institution most able to supervise distribution of the products.

The costs are substantial, on the order of the shortfall in the Global Fund's funding—that is, $7 billion per year. The benefits are also substantial. The estimates are uncertain. Using a conservative version of the numbers presented in the text, one can anticipate perhaps a 1% increase in the growth rate of nations in which these diseases are properly treated. For the poorest nations as a whole (whose total income is $1,072 billion, according to the World Bank's *World Development Report*), assuming that the drugs provided under the programme can significantly alleviate the disease burden, a 1% increase in the growth rate would add approximately $10 billion a year to world GDP.

Task 2: Develop new public goods for the poor.

The second task is to develop new public goods, such as medicines and seeds, for the poor in nations that will for many years be unable to participate significantly in developing these goods for themselves. This is a public sector issue. The emphasis should be on public sector R&D (such as that conducted by the CGIAR and the medical PPPs) focused on the agricultural needs of the poorest developing nations and on the infectious diseases found primarily in developing nations, including specific strains of HIV as well as tuberculosis and malaria. The key need is further public funding in forms such as PPPs, prizes and perhaps even new institutions, such as an international analogue to the US National Institutes of Health or the UK Medical Research Council.

The central need is for additional funding for the institutions conducting this research, particularly the CGIAR and the PPPs in the medical sector. Once new medical products are developed, an institution like the Global Fund will be needed to purchase and distribute these products. The CGIAR's capabilities are quite solid, but it needs additional funding from donors. To consider whether new institutions are needed in the medical sector, and to review the effectiveness of the various PPPs and decide how to increase support wisely, the best first step would be taken by an expert committee (not a political committee). It might be convened by the WHO, perhaps working with the World Bank.

The initial costs are significantly smaller than for task 1: perhaps doubling the CGIAR budget (about $300 million per year) and filling the shortfall of expected needs of the medical PPPs (another $600 to $700 million per year), for a total of about $1 billion per year. But this

would cover only R&D costs. As new products are developed, much more funding will be needed to purchase and distribute them. (Note, however, that the development and use of new preventive products would decrease the ultimate need for the therapeutics being supplied by the Global Fund and thus decrease the overall costs of task 1.) The returns on successful research can be reasonably expected to be at least in the 50% per year range found for agricultural research—and probably much higher for preventive medical research.

Task 3: Provide technological opportunities for scientifically sophisticated developing nations.

The third task is to enable scientifically sophisticated developing nations (such as Brazil, China and India) to participate more fully in the world's industrial development process. This task involves significantly new economic analysis of how these nations actually acquire and use technology and of how their development is affected by the international trade and intellectual property law regime. Following that analysis appropriate new national trade and antitrust policies should be developed, and perhaps new international agreements negotiated. These negotiations may be difficult because developed nations may feel threatened by competition from these developing nations.

The key institutions are the OECD (which has been the leading international organization in the role of technology in economic growth but is limited to developed nations) and those which are more focused on the developing world, such as UNESCO, UNCTAD and the World Bank. Inculcating new thinking might be best accomplished through a consortium of several of these institutions. Once appropriate treaty arrangements evolve, the negotiation of the actual agreements would probably occur in the WTO.

The costs of the effort needed are quite small, probably on the order of tens to at most hundreds of millions of dollars, as are the costs of negotiation. It will be necessary to improve the economic analytic capabilities of antitrust enforcers in the developing nations, which involves a cost that is probably on the same order. New agreements affecting the economic potential of these nations might have enormous financial implications. Taking into account the possible role of technology in development, this might ideally involve increasing the growth rate of those middle-income nations that are actually benefited by a percentage point or two. This means

a number—which must be viewed as highly speculative—on the order of $20 to $40 billion per year for Brazil, India and China and perhaps double that for all middle-income nations. As these new industries grow, they would impose some costs on developed nation industries in the form of trade costs rather than foreign assistance costs. At the same time, the growth of new markets would almost certainly provide significantly larger and net-positive benefits for the developed nations. (Indeed negotiating any agreements that significantly affect the competitiveness of these middle-income nations would almost certainly require careful economic analysis of the dynamics of the interactions between the two groups of nations—a dynamic that is likely to involve mutual benefit in growth.)

Task 4: Enable poorer nations to become scientifically sophisticated.

The fourth task is to enable poorer nations to become scientifically sophisticated and to participate more effectively in their own development. This is a governance and capacity-building issue. The task begins with study: What brings a poor nation to what might today be called technological take-off, as has occurred in China, Korea and Taiwan (province of China)? Certainly part of the answer lies in characteristics such as good governance and absence of civil war. But part must lie in education and access to science. (As noted above, the balance between universal education and improved higher and tertiary education requires careful thought in today's technology-oriented world.) The follow-up must be improved education and scientific capability at both elementary and advanced levels.

For the study phase, the key institutions are UNESCO, the OECD and the World Bank. For the implementation phase the same institutions are relevant, as are the national education ministries of the poorer developing nations.

The study phase is relatively inexpensive, at the same level as the studies already described. The implementation phase, however, will be enormously expensive—the estimated funding needed to achieve universal primary enrolment alone by 2015 is $9 billion per year.[68] The benefits will probably be at the 8% to 25% level typical of education. But, for the nations in which there is an actual takeoff—only a few, in the first decade or so—the return can be expected to be much greater and on the order of several percentage points of increase in the growth rate.

Task 5: Improve global systemic arrangements.

The final task deals with the global systemic arrangements. The task is to choose among research, negotiate and implement treaties that strengthen global research capabilities and the global scientific and technological commons. It is also essential, especially in the medical and industrial sectors, to understand the cost-effectiveness of research better, and to create institutional mechanisms to regularly re-evaluate the focus of international public sector support for scientific research oriented to the needs of developing nations and global public goods.

The key institutions for the research are the ones already mentioned: UNESCO, the OECD and the World Bank. The institutions for negotiation are likely to be special-purpose international organizations (such as WHO, FAO or UNEP) or the WTO.

The costs of the research and the negotiations are small—again in the tens to hundreds of millions of dollars. Funds at the same general level will probably be adequate for the continuing work. Some arrangements developed or negotiated in this way may require significantly increased expenditures to support research. The pay-offs of better focusing the research are likely to be substantial—the estimate is necessarily even more rough than others in this annex but might be on the order of a portion (perhaps 5%) of the level of benefit expected from the science detailed in task 2. The benefit of strengthening the global scientific and technological commons is even more speculative but could be estimated by assuming that doing so will increase the return on the large existing investments in research, which, globally, are well over $500 billion. The return on these investments (which include industrial research) must be, conservatively, at least $50 billion per year; a more vibrant commons might plausibly increase that number by a few percentage points.

Notes

1. See Scherer and Weisburst (1995).
2. Calculated from the World Health Organization's "The 3 by 5 Initiative" Web site, available at www.who.int/3by5/en/, which states that 400,000 out of 6 million patients are receiving the drugs.
3. See Global Forum for Health Research (2004).

4. See Médecins sans Frontières Access to Essential Medicines Campaign (2001).
5. See PhRMA (2004).
6. See National Institutes of Health (1999).
7. See Sander and Widdus (2004).
8. See Walsh and others. They conclude from a survey that the problem is usually solved through such devices as licenses, engineering around and off-shore research. But see also Edwards and others. They conclude that, for biotechnology-based drugs, universities and biotechnology firms (the likely holders of research-tool patents) take roughly 36% of profits on a drug, clearly enough to affect the pharmaceutical firm's financial planning.
9. For a detailed review, see Barton (2003).
10. See Dalrymple (2004).
11. See Pardey (2004).
12. See Pardey and Beintema (2001).
13. See Haggblade and others (2003).
14. See Pardey (2004). Presents a curve, over time, of CGIAR funding.
15. See Strelneck and Linquiti.
16. Available at www.gefweb.org/.
17. See Noland and Pack.
18. See United Nations Conference on Trade and Development (2003). See also the World Trade Organization (2002).
19. See United States National Science Foundation (2004), pages 4–69.
20. See table 1 in Maskus (2004).
21. See Barton (2003).
22. See World Bank (2002).
23. See United Nations Conference on Trade and Development (2003).
24. See Watson and others (2003), page 2. The citations are omitted; the most important refer to OECD's *Science, Technology and Industry Outlook 2000.*
25. See Watson and others (2003), page vii.
26. See United States National Science Foundation (2004), pages 4–47.
27. Calculated from table A1, UNESCO (1999).
28. Electronic Publishing Trust for Development. 2004. Submission to the House of Commons Science and Technology Committee's Inquiry into Scientific Publications. 19 January 2004.
29. See United Kingdom Intellectual Property Rights Commission (2002).
30. Available at www.aftechfound.org/.

31. See www.scidev.net/ms/open_access/ and the Directory of Open Access Journals at www.doaj.org/ for current examples.
32. See Lybbert.
33. See Atkinson and others (2003).
34. For example, see Reichman (2000).
35. See Zittrain (2003).
36. "Summary of Principles Agreed at the International Strategy Meeting on Human Genome Sequencing," 25–28 February 1996, Bermuda. Available at www.gene.ucl.ac.uk/hugo/bermuda.htm.
37. National Institutes of Health, Final NIH Statement on Sharing Research Data, 26 February 2003. Bethesda, Md.
38. Refer to Zittrain (2003) to locate Michael Morgan's "New Paradigms in Industry: The Single Nucleotide Polymorphism Consortium," in Steering Committee, etc.
39. See Zittrain (2003).
40. See Lanjouw (2003).
41. Available at www.earth.columbia.edu/cgsd/prizes.
42. See Wright (1983).
43. See Kremer (2001).
44. See Maskus (2004).
45. See Stansfield and others (2002).
46. See Sander and Widdus (2004). And see, generally, Nwaka and Ridley (2003); and Wheeler and Berkley (2001).
47. See OHE Consulting (2004).
48. A 300-page compendium of the relevant texts of such treaties is available at UNCTAD/ITE/IPC/Misc.5, *Compendium of International Arrangements on Transfer of Technology: Selected Instruments* (2001). For a review of activity under one such clause, see Executive Secretary, Convention on Biodiversity, *Technology Transfer and Cooperation*. UNEP/CBD/COP/7/INF/9 (20 December 2003).
49. See Hubbard and Love (2004).
50. See Arzberger (2004). The OECD statement is found at *Science, Technology and Innovation for the 21st Century*, meeting of the OECD Committee for Science and Technology Policy at Ministerial Level, Paris, 29–30 January 2004, Final comminuque, Annex 1. Declaration on access to research data from public funding.
51. See Reichman and Uhlir (2003).
52. Refer to Zittrain (2003) for Steering Committee; and Nelson (2004).
53. Barton, John H., and Keith E. Maskus. "Economic Perspectives on a Multilateral Agreement on Open Access to Basic Science and Tech-

nology" (forthcoming). Also see John H. Barton, "Preserving the Global Scientific and Technological Commons," presented to the ICTSD Policy Dialogue, Geneva, 11 April 2003. Available at www.southcentre.org/info/southbulletin/bulletin56/bulletin56-05.htm.

54. See Alston and others (2000). And see Pardey and Beintema (2001).
55. See Thirtle and others (2003).
56. See, for example, Jones (2002).
57. See Cutler and McClellan (2001).
58. See Nelson (1999).
59. See Gallup and Sachs (2001).
60. See Mills and Shillcutt (2004). The ranking of interventions, including those in several sectors, is available at www.copenhagenconsensus.com/.
61. See Jones and Williams (1997).
62. See Cameron (1998).
63. See Kim (2002).
64. See the Korean example discussed in Andersson and Dahlman (2001).
65. See Psacharopoulos and Patrinos (2002).
66. See World Bank (2002).
67. See, for example, Watson and others (2003). And see InterAcademy Council (2004).
68. See Delamonica and others (2001).

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Information as a Global Public Good

Chapter 3

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This chapter discusses information as a global public good (GPG). In the past 20 years countries and international governance institutions have markedly strengthened the regimes for protecting private exclusive rights to the use of new information. While there may be benefits for global processes of innovation and technology transfer, this trend raises important questions about the distribution of gains and losses, the impediments that private rights may have for the provision of other public goods and the need to preserve the global public domain in knowledge. For example, the expansion of patents in the United States into research tools and other forms of basic knowledge and the implementation of strong private ownership rights in databases in the European Union could significantly restrict the access of scientists and educators in developing countries to fundamental scientific results.

After an introduction, this chapter discusses the essential characteristics of information as a GPG, including the nature of static and dynamic market failures in providing and disseminating it—a problem in any economy, but more so internationally. Central to the discussion is identifying the specific differences between information and other GPGs. Some important distinctions, for purposes of global policy, include the differentiated character of information into basic knowledge and applied commercial information, the inherent ability of information to cross borders, the heavy extent to which information is a key input into other goods (including GPGs), the natural policy conflicts among information-producing and information-consuming countries and the central importance of the incremental nature of developing and gathering information.

Next, it examines intellectual property rights (IPRs)—central to policy aimed at encouraging the development and dissemination of information. The use of IPRs to establish exclusive rights to market technologies, brands, creative

goods and other forms of information generates both gains and losses, which are distributed differently across countries. This section offers advice to developing countries for setting IPRs standards consistent with international requirements. But most important is to consider the nature of global protection through agreements at the World Trade Organization (WTO) and elsewhere.

It then analyses the need for a lead agency for information. It points out that a centralized knowledge institution, which would be charged with developing and disseminating new knowledge on a global scale, would be unworkable. Rather it should be feasible to work with existing institutions to improve information gathering and sharing, policy coordination (including setting standards) and performance evaluation. Specialized roles would be played by various agencies, including the WTO, the World Intellectual Property Organization (WIPO), the World Health Organization (WHO), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations Conference on Trade and Development (UNCTAD). But none of these institutions is well positioned to take on a central coordinating function. The World Bank—given its analytical and professional expertise, its existing extensive work in information and development, its role in encouraging policy reforms in areas that affect information sharing (such as education and trade and investment policy) and its experience in policy coordination—would be the best organization for this task.

Finally, it makes a series of policy proposals, some likely controversial.

- *Establish an additional fee on international patent and trademark applications to improve administration and enforcement of IPRs and technology policies in developing countries.*
- *Announce a global moratorium on strengthening standards in IPRs, including through the WTO and bilateral trade agreements, to provide countries an opportunity to understand their new systems and experiment with innovation policies. One exception would be the extension of geographical indications to certain products in the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement.*
- *Consider expanding visa allocations, within the General Agreement on Trade and Services (GATS) framework, for temporary migration of technical and managerial workers from developing countries to work temporarily in developed countries.*
- *Expand the role of the WHO as a location for globally provided assistance funds to encourage the development of new drugs for diseases occurring primarily in low-income countries.*
- *Work towards establishing international pools of knowledge in key areas of public goods (health, environment, education, agriculture) for wide-*

spread access. If charges are needed, such pricing could be on a development-differentiated basis.

- *Negotiate at the WTO a multilateral treaty on access to basic science and technology. Such a treaty would push the results of publicly funded basic research into the global public domain.*
- *Designate the World Bank as the lead agency for information gathering, policy coordination and evaluation.*

This chapter discusses information—including such fundamental aspects as basic knowledge, facts, data, technological innovations and information products—as a global public good. Information as a GPG arises from its essential non-rivalness and the (perhaps) inherent inability of its developers to exclude others from using it. Stemming from these characteristics, information can flow among users across borders, making it difficult to retain exclusive control over international uses.

Moreover as a matter of international public policy there are deep questions about whether and how authorities should permit or encourage such exclusion. Important forms of information, such as the outcomes of basic science, research results, medical technologies and educational materials, embody economic and social externalities that argue for ensuring widespread access at low cost. In this context, policies might err on the side of open or differential access on behalf of societies in particular need. However a policy prescription in favour of access can limit incentives for both investment in new information creation and the orderly dissemination of information through market-based mechanisms.

Thus, the question of optimal international provision and distribution of new technologies and information is deep and complex. It involves questions of federalism (at which level of government should such goods be provided and how should they be distributed?), sensible delineations between private and public provision, consideration of the extent of spillovers across borders and determination of the nature and scope of technology-protection policies that might strike an appropriate balance between the needs of developers and users.

In the past two decades countries and international governance institutions have markedly strengthened the regimes for protecting private exclusive rights to the use of new information. These regimes, largely through the specification of tighter and more harmonized IPRs, have shifted the global balance in favour of the private assertion of ownership to knowledge and information. In the long run, this systemic shift could

be globally beneficial if it improves incentives for investment and distribution of technologies and information. In the short run, it promises to transfer income from information users (often in developing countries) to information developers (overwhelmingly in developed countries).

Perhaps more important, stronger private rights raise questions about the ability of governments and users to benefit from low-cost access that may have pertained in a more permissive environment. Part of this access stemmed from the availability of "policy space", meaning the ability to encourage uncompensated knowledge spillovers through weak IPRs and other technology-related policies. A significant measure of this policy space has been eliminated under terms of the new global IPRs regime, reflected largely in the WTO's Agreement on TRIPS. Other potential constraints arise from the so-called TRIPS-plus provisions of regional and bilateral trade agreements, negotiated by the United States and European Union, and from new treaties negotiated under the auspices of the WIPO. These tighter policies for information access and use may generate more useful technologies and products over time and improve markets for disseminating them. In the short run, however, they can raise costs and access barriers that could be harmful, especially in poorer economies with limited information infrastructures.

Striking an appropriate balance between encouraging innovation and information development, on the one hand, and low-cost and widespread dissemination of information, on the other hand, has never been straightforward, even within the context of a single economy. With multiple economies at varying levels of economic development, the questions become more complicated. Furthermore how best to adequately provide this public good in the global economy is a difficult issue. For some technologies with strong social spillovers (such as essential medicines for neglected diseases of poor nations) a policy of coordinated public subsidies for research and development and cheap distribution may be optimal. For others a significant reliance on indirect provision through exclusive proprietary rights might work better. But significant tensions remain between countries that develop technology and those that use it.

Such issues are analysed from the standpoint of an economist concerned with issues of efficient public provision, accounting for the needs of developing economies. First, information as a GPG is considered, focusing on externalities, market failures and interaction with social objectives. This leads naturally to a discussion of approaches to public and private provision in an international context. Next, an overview of es-

sential concepts of intellectual property protection in the international economy is provided. Attention is paid to questions of policy space and how countries could preserve and use it sensibly for economic development. Then, the international institutional infrastructure for regulating incentives for the support and dissemination of critical information goods is analysed. Finally, some thoughts on policy proposals for moving forward are offered.

Information as a global public good

Generations of scholars have explained the fundamental characteristics of knowledge as a public good. Thomas Jefferson, for example, compared an idea to the flame of a candle, which could be used to light other candles without diminishing the original light (David 1993). The defining feature of knowledge is its non-rivalry: one person's use of a mathematical algorithm in no way diminishes another's ability to use it. Thus complete and open access distributes the gains from the use of ideas widely without reducing the ability of their originators to use them. In turn, the social value of an idea to multiple uses is the sum of all the individual valuations, a sum potentially far larger than its value to an individual user. Optimal social policy would call for the widest possible use of existing knowledge, assuming the marginal cost of additional provision is small.

A second feature of knowledge is that it may be non-excludable, implying that it is difficult or impossible to maintain exclusive possession while putting it to useful or gainful purpose. Attempts at secrecy often fail and, in the extreme, some technologies such as medicines and software are easily learned through simple imitation. There may be technical and legal solutions to generate exclusivity, but the stronger these are the more costly is access to use the information.

Taken together, these characteristics imply that the returns to investing in ideas may not be captured by an original creator. Moreover private inventors would not take into account the social gains from broader but uncompensated use of new information in deciding their research programmes. Accordingly market actors would not make costly investments in developing new information, and, because of the resulting underinvestment, society would suffer from a diminished rate of technical progress. This non-appropriability problem implies that knowledge is a public good.

This market failure calls for public intervention, which has generally occurred through a mix of two policies. The first approach, adopted by numerous governments, is to provide substantial direct funding to research to curb underinvestment. Thus the US government's annual spending on research grants to universities, government laboratories and private research centres amounts to tens of billions of dollars. There are also subsidies through tax incentives for private firms to undertake research and development. Systems in Europe and Japan are similar. These programmes have accounted for the development of massive amounts of basic technology that helped support applied commercial innovation.

The second approach is to secure the ability to earn returns to investment in research by providing exclusive IPRs. Patents, copyrights, trademarks and trade secrets protect different forms of innovation and operate in different ways, but all offer exclusivity in the use of designated subject matter. These are essentially market-based inducements to creating new information—developers are free to invest in whatever programmes they think will achieve market success. They are also incentives for placing new products and ideas on the market, which is necessary to achieve welfare gains from innovation. In this sense patents are an effective selection mechanism for innovation. Only those who believe their idea can make money will invest their own resources. In contrast, government direction or funding of commercial research is generally ineffective. Public agencies might have limited information about market prospects and might make politically motivated and inefficient allocations of research funds.

Intellectual property protection can, in some circumstances, support substantial market power, generate wasteful duplication of research and development spending and limit access to information. Nevertheless, they are an integral support for technological competition, at least in innovative economies. Note that because IPRs (or market lead times and secrecy) can render information at least partially excludable, information is often thought of as an impure public good.

Extension to global public goods

GPGs have been defined as goods (including policies and infrastructure) that are systematically underprovided by private market forces and for which such underprovision has important international externality effects (Maskus and Reichman 2004). An "externality effect" means that a failure to provide the public good imposes costs on third parties. For

example, pollution arising in some countries may affect health status in others, or financial volatility in one nation may generate follow-on fragility elsewhere. In general national policy-makers are not likely to consider the well-being of foreign citizens in setting their own policies regarding public goods, which is why GPGs require some form of global coordination (Arce and Sandler 2001).

How to organize the provision of GPGs without adequate international policy mechanisms or agreements has become an increasingly important and complex question in recent years. In practice this task has been left largely to national authorities. Because there are international spillover effects, however, reliance on national provision fails to meet global needs efficiently or equitably. International approaches to providing GPGs, including information, are required because national regimes generally disregard cross-border externalities and the resulting need for coordinated policy intervention.

What is different about information from other GPGs? Describing the features of knowledge and information that distinguish them from other GPGs is important. Consider the list of GPGs put together by the Secretariat of the International Task Force on Global Public Goods: peace and security, disease control, global commons, financial stability, open trade and knowledge sharing. Each shares important characteristics. For example, countries acting on their own will tend not to consider the interests of other nations in setting their health policies or security policies. The global environment is a common resource that would not be sufficiently protected if left to market decisions about use without public regulation. Financial stability and open trade offer real spillover benefits to countries beyond the groups that may undertake them, suggesting that free-riding may tend to reduce the level of these policies below what is globally optimal. But there are a number of characteristics of knowledge that make its provision on a global scale conceptually distinctive from the other GPGs.

First, information and basic knowledge have the virtually unique characteristic that, while it often requires significant monetary and intellectual investments to develop new research outcomes, ideas, novels, brands and the like, the cost of distributing these items to additional users is extremely low. Indeed the cost effectively is zero for goods distributed electronically. Thus such items tend to have high fixed costs and minimal marginal costs, a characteristic that is often used to describe "intellectual property goods".

Other GPGs arguably have the same characteristic. Efforts by one country to establish peace and security may be extended to other nations through a treaty. An open trade regime, achieved after difficult negotiations, is automatically extended to all users in included nations.

The relevant distinction is that while peace, open trade and financial stability are necessarily provided by or coordinated among national governments, much information is more efficiently developed by private firms. Governments have a significant role in supporting—or even directly developing—basic research and knowledge. However, for items of industrial, commercial or cultural value it is more efficient to encourage specialization by innovative private or quasi-private interests. Governments generally do not have the specific knowledge and foresight to choose appropriate projects, while private firms would risk their investments only in items they believe will succeed in an uncertain marketplace.

In the areas of peace, open trade, financial stability and disease control, governments rationally would welcome extension of these goods to broader users or countries. The same is not true of private information developers, however, who must make some excess revenues over marginal costs to recoup investment costs. These excess revenues are supported largely by IPRs. Thus, the former items are publicly provided and rationally extended at low cost. Information of commercial utility is developed privately in the shadow of regulatory support, with an inherent conflict between static needs for wide distribution and dynamic needs for distribution at a revenue mark-up.[1]

Second, there is an important difference between basic research results and commercial information. Basic research results are closer to the concept of a pure GPG, like international security, and global policy should aim at investing in additions to the knowledge commons and widely distributing its outcomes. Because fundamental knowledge—such as mathematical theorems and the periodic table of the elements—are completely non-rival and support further development everywhere, they have traditionally and rationally been kept in the public domain. Many other areas of basic research—such as the map of the human genome, development of genetic research tools, invention of higher order life forms, understanding of the biological characteristics of wild food grains and the ability to forecast global weather patterns—may be considered fundamental and properly in the global knowledge commons.

Placed into the domain of private exclusive rights, such knowledge can be prevented from advancing and disseminating basic understand-

ing of education and science on a global scale. One can appreciate this difference by considering the frequent claims that "no one can own information" and that "access to knowledge is a basic human right". These claims are difficult to assess on economic grounds, but they make the important point that public policy needs to think clearly about the implications of extending private rights to what might be considered elements of the public domain.

Third, information is arguably less geographically limited than some of the other GPGs, such as disease control and the environmental commons. Some information really is localized, such as knowledge of local soil conditions or customer databases. Much of it, however, and probably the whole stock of basic research knowledge, could be of utility if made available to users in many countries. International knowledge spillovers do call for a coordinated approach to knowledge generation and information sharing.

Fourth, information is a central input into the effective provision of all the other GPGs. Peace, disease control, environmental protection, open trade and financial stability depend on access of both public and private actors to information about national policies, endowments and technologies. The fact that technologies in particular may be privatized but also affect the ability to develop military systems, environmental controls and standards, and health interventions makes information a specialized but critical input. Deep questions arise about the implication of globalized private rights in information for the ability of authorities to provide public goods.[2]

Fifth, because of the reliance on private resources (or even scarce public resources, on which some economic return may be necessary in political terms) to develop information through the use of IPRs, there are strong policy conflicts among nations. Some countries are, or expect to be, significant net exporters of information, technologies and IPR goods. These are the technologically advanced, generally richer countries. Others, the low- and middle-income countries, will remain net importers of these items for some time to come. Their firms, consumers and public authorities have an incentive to free ride on available international technologies, though their ability to do so depends on a number of other factors. This policy conflict, which emanates from real economic differences, makes international agreement on technology protection policies especially difficult.

In contrast, the other GPGs, except perhaps the global commons, do not face this rational policy conflict. All countries have a rational inter-

est in open trade. The fact that trade agreements are difficult to reach reflects underlying specific economic interests rather than the national well-being. Financial stability and security are similar in this regard.

To put things differently, international harmonization or coordination of IPRs generates winners and losers in economic terms, though the scope of these effects is difficult to assess (Maskus 2000). In contrast, extension of global security, stability and open trade should generate gains in all countries, net of adjustment costs. One implication is that coordination of IPRs at strong levels of protection should be accompanied by compensatory payments to countries that may be made worse off in the short run. These payments were thought to be achieved by many in the Uruguay Round, which founded TRIPS, largely by commitments on the part of developed countries to reduce their agricultural trade barriers. This trade-off has yet to be achieved, and progress in the next round of trade negotiations depends on making a stronger link. For purposes of this chapter, however, the main point is that there are legitimate international policy conflicts for rights to use technical information.

Sixth, the development and use of information are essentially done on an incremental basis, with progress depending heavily on access to prior knowledge. This is as true of science done at universities and laboratories as it is in the realm of private technological competition. This incremental and adaptive nature of information is a defining characteristic of technical change, and policy needs to take this into account.

Issues of provision. Many critical public goods have become increasingly global in their effects and supply needs. But the organization, provision and distribution of GPGs are at an early and critical stage. This situation is exemplified by the emerging global system of intellectual property protection. Traditionally IPRs were constituted as national policies, generally neglecting to coordinate standards across countries. However wide variations in national regulations can have significant effects on international trade and investment and generate important static and dynamic global externalities (Maskus 2000, 2002).

The recent economics literature illuminates several reasons why, acting solely in their own interests, countries would protect new technology and product development at a level that is lower than would be globally optimal (McCalman 2002; Grossman and Lai 2004; Scotchmer 2004). The main reason is that some of the gains from new ideas accrue to consumers and users in other countries, a benefit that national policy-makers would not consider in setting domestic standards. Countries with limited innovation capacities would choose to free ride on

foreign research and development investments by offering only limited technology protection. Accordingly not enough investments in information and knowledge generation would ensue under a strictly national system. Some means of international coordination of IPRs and technology transfer policies would, therefore, move global rules closer to the optimum and expand investment incentives.

To be effective and manageable, however, this international approach must take into account the development and social needs of different economies (Hoekman 2006; Hoekman, Maskus and Saggi 2005). Thus, there must be a mix of differential and flexible standards, along with some kind of compensatory side payments to induce poorer nations to adopt and enforce stronger IPRs. In fact, there is some flexibility permitted in implementing the TRIPS standards (Reichman 1997), discussed in the next section. But to gain from these flexibilities requires a degree of legal and regulatory expertise that might exceed the capacity of many countries for the foreseeable future. Thus, there are important questions about the sustainability of the attempt in TRIPS to resolve the international externality aspects of protecting new information goods.

Many critics argue that the international agenda for increasing intellectual property protection has been developed and implemented by developed country governments representing the commercial interests of a limited set of industries, without serious consideration of even the long-term effects on real innovation, let alone international equity or provision of GPGs. Indeed, whether the system strikes an appropriate balance between the needs of developers, users and public authorities on a global scale remains open. At least in the short to medium term, it is likely to shift the rules sharply in favour of intellectual property developers, while the potential for long-term gains for the poorest countries seems questionable (McCalman 2001; Smith 2001).

Thus, while the evolving international system of IPRs bears characteristics of a GPG, it seems flawed in a number of fundamental ways. For example, TRIPS constrains governments from pursuing certain avenues for promoting imitation, follow-on innovation and related competitive policies. Moreover, these rules affect the ability of governments to provide other essential public goods that require access to new information. Here private rights in information could raise obstacles to using new technologies that could improve provision of education, environmental protection, healthcare and scientific research.

There are no definitive principles for determining the best mix of public funding for research and exclusive private rights to research

outcomes. The conventional solution in most technologically advanced societies has been to distinguish between investments in basic scientific knowledge and applied research in specific processes and products with commercial applicability. While such a distinction is often difficult to make, scientific knowledge and basic research might be considered true public goods in that they are both non-rival and offer general knowledge that can support multiple uses. Private markets would fail to invest sufficient resources in their generation, requiring a public solution. Commercial products are more properly construed as impure public goods or quasi-private goods because of their specificity and relative ease of technical or legal excludability. Regulatory instruments generally are enough to ensure their provision.

This distinction is critical for both conventional research policy and IPRs. Most US government research findings and data, except those reserved for security purposes, traditionally have been placed into the public domain. University scientists operate in a vigorous open source mode in which their finding s are debated and published for wider use. The gains to successful scientists in this environment stem from building reputations rather than ownership rights. By tradition, therefore, basic scientific results have readily entered the public domain.

Conventional conceptions of IPRs embody this distinction between basic knowledge and commercial information. For example, in most countries outside the United States basic discoveries (as opposed to inventions), mathematical algorithms and genetic research tools are excluded from patent eligibility. Further, for a patent to be awarded an invention must meet a utility standard under which the technology must be reduced to some industrially or commercially useful form. A rigorous utility standard is a basic method by which patent authorities deny private rights to basic knowledge. In recent decades the United States has significantly weakened its utility standard and now awards property rights on such basic enabling technologies as genetic research tools and specific expressions of genomic knowledge. The United States is fairly unique in this context—only Australia and Japan have moved significantly in this direction also. At present, such patents are not awarded in most other jurisdictions. However pressures to expand the domain of private property through the scope of patents are growing in Canada, the European Union and other developed nations.

Also relevant is the inventiveness standard, under which new technologies must display true creativity in order to achieve exclusive rights.

However the European Union's Database Directive ignores this requirement by awarding patent-like protection to simple compilations of data and information. This reduction of a central bar to patenting also threatens to remove important research results from the public domain.

Another policy that blurs the distinction between research that generates basic knowledge and subsequent development activities is the operation of the US Bayh-Dole Act. Under terms of this law US universities and their faculty can, under an expansive set of circumstances, assert patent rights on new information and technologies, even if the research underlying those items was publicly funded. Universities have increasingly registered patents to license the knowledge to commercial enterprises for applied use. The advantage of this approach is that it may encourage more rapid dissemination of scientific results into applied products. It does, however, raise significant concerns about the meaning of public research and basic knowledge.

Taken together the US and EU approach to treating some public research findings as commodities on which property rights may be asserted has eroded the distinction between basic knowledge and applied research and development. The political and economic justification for mixing public funding with private rights is generally expressed in competitiveness terms. Specifically it is argued that this approach will generate greater revenues from the public investment in research and provide more incentives for product development, to the ultimate benefit of society.

Whether this salutary outcome will emerge is by no means a settled issue among scientists, economists and legal scholars, and several have expressed significant concerns (Mowery and Sampat 2004; Nelson 2004). A careful look at licensing regimes emerging from patents on basic tools in biomedical research found that transactions costs in scientific research have increased markedly (Heller and Eisenberg 1998).[3] Ideas are inherently differentiated, and the costs of combining them into useful technologies likely are raised by IPRs on scientific knowledge. Thus it may be that patents on basic technologies can be harmful to dynamic competition by raising licensing costs and extending reach-through proprietary rights to all potential innovations using those technologies (Aoki and Nagaoka 2003).

This concern is magnified by the fact that open-access science and commercial research traditionally operated in complementary fashion, with open-access science having little direct utility but supporting a range of innovative products and applied technologies. That is open

science raises the expected returns to private investment in proprietary research and development (David 2003). These spillovers arise for two reasons. Access to knowledge provides applications developers with information about promising areas in which to invest, increasing the efficiency of capital allocation. Further, public funding for university research and training generates high-quality technical personnel that often move into industrial employment, a key element of technology transfer. These gains serve as a general subsidy to applied research and development, but as proprietary rights are extended on public research results the scope for such spillovers is likely to be reduced. Thus an appropriate mix of IPRs and public provision of research must strike a balance between resolving appropriability problems, in order to induce investment and commercialization, and ensuring that basic knowledge is widely accessible.

The increasing application of proprietary rights to publicly funded and basic research results may, therefore, be problematic even in the United States and the European Union. Research universities and large firms in those countries may be able to engage in patent pooling and cross-licensing agreements so that their research programmes are not greatly inhibited (Walsh, Arora and Cohen 2003). However start-up firms and small enterprises in developed countries are distinctly disadvantaged in this environment (Reichman and Uhlir 2003).

This concern is magnified for research processes in most developing countries. Public research institutes, university science and education, and the development and diffusion of applied technologies all are dependent on access to basic knowledge, which is overwhelmingly generated in developed countries (Evenson 2005). Increasing privatization of scientific data by entities in the developed countries could sharply limit the diffusion of knowledge into science and competition in developing countries. Few governments in developing countries are able to mount significant public funding for basic research in universities and institutes. Thus one significant outcome of recent IPRs policy in the United States and the European Union will be higher costs for, and diminished international access to, the scientific results that have been a foundation for technical change.

One may appreciate this problem by recognizing that public research traditionally has generated large spillover benefits across international borders through education, research and competition. Technological change is the main engine of growth, but for lagging countries to learn

from and ultimately contribute to such change requires educational, scientific and technological capabilities. Thus access to knowledge is important for economic growth and transformation in developing countries. The more such knowledge is protected by exclusive rights, the lower these spillovers are likely to be.

Adopting and improving flexibilities in intellectual property rights

All members of the WTO, including the least developed countries, were obliged to undertake legislation implementing the minimum standards of the TRIPS Agreement by the beginning of 2005.[4] Almost all have complied, though endemic problems remain, especially with enforcing IPRs. A number of additional countries, such as Viet Nam, hoping to enter the WTO soon are in the process of adopting TRIPS-consistent IPRs regimes.

On this basis the world has engineered a significant movement towards effective harmonization of substantive intellectual property standards, including patents, trademarks, geographical indications, copyrights, plant variety protection and protection of confidential business information or trade secrets. This fact immediately raises the issue of whether such harmonization is excessive, say, by preventing low-income countries from adopting limitations and exceptions to IPRs that help them meet societal goals for developing, acquiring and using new information.

The global question: is harmonization appropriate?

Most legal and economic scholars would agree that a "one size fits all" approach in IPRs, as in any area of complex business regulation, is not sensible for public policy. While the coordination issues discussed above support a strong case for a multilateral agreement on IPRs, optimal standards for protecting information in the United States are not the same as those for Brazil, China or Viet Nam. Thus extensive harmonization is a questionable global strategy, and rigid insistence on ever-increasing global standards raises concerns about the sustainability of TRIPS itself (Maskus and Reichman 2004).

In fact TRIPS does offer flexibility to countries to implement protection standards that are appropriate for enhancing competition and

limiting the costs of public goods provision in developing countries. Several authors have commented on this situation, which are overviewed and updated here.[5]

Intellectual property rights for development and appropriate information use

Though it may generate costs in the medium term, stronger intellectual property protection could produce gains in the long run through greater domestic innovation and cultural creation, enhanced economic transformation and increased technology transfer. These gains are more likely to materialize if countries adopt standards and support policy regimes that promote competitive processes on their markets.

Thus consider a programme of standards that, while consistent with TRIPS, should favour dynamic competition in markets where rivals may need access to new technologies in order to adapt them to local conditions and improve commerce. Beyond this basic requirement of non-discrimination, TRIPS offers considerable flexibility in implementing appropriate standards. In managing this task, however, it is important that governments do not discourage inward transfer of technology and suffocate innovative efforts of domestic firms (Hoekman, Maskus and Saggi 2005).

A rough guideline can be developed by dividing developing countries into three types and listing IPRs standards that seem most sensible for each group. The first is low-income countries, which have limited skills and weak environments for advanced invention, but some capability at small-scale innovation and cultural creation. The second is middle-income countries, which have a strong imitative capacity and a reasonable human capital endowment. Such countries need to encourage technology adoption and incremental innovation. The third is high-income countries, which display strong human capital endowments and a growing capacity for invention and commercialization. As countries become more developed they would find it advantageous to strengthen their IPRs for purposes of supporting innovation and technology transfer. Discussed here are policies that are sensible for the low-income and middle-income countries.

Before considering detailed issues of setting standards, it is useful to define various forms of IPRs. Patents are exclusive use rights granted to the first to invent a new product, process or technology—protecting the rights to profit from developing new ideas. These rights cover

production, sale, licensing, importation and other uses for a fixed term (minimum of 20 years under TRIPS). The patented item must be novel, non-obvious to others in the field (containing an inventive step) and capable of industrial or commercial application. In return for these rights the patent application is published so that the technology is revealed to the public. Other forms of patents include utility models or petty patents, which are shorter term and narrow patents on small-scale innovation, and industrial designs, which protect the ornamental features of new products, typically for 10 years. Governments may limit the scope of patents through their definitions of what may not be patented, how narrowly the exclusive claims may be identified, whether it permits others to perform research on the patented technology and other means. Such limitations must be consistent with global rules under TRIPS.

Trademarks—and related items such as brand names, collective marks, service marks and trade dress—are words, logos, pictures or symbols that uniquely identify the origin of specific products. Trademark owners have exclusive rights to attach these items to their products or services in order to signal legitimacy to purchasers. Trademarks are registered for a particular period of time and generally are renewable indefinitely, so long as they remain in use. Some trademarks become generic words and protection must be given up in favour of other marks. A closely related device is the geographical indication (in various forms), which identifies the location where a good was (at least partly) produced. That location should embody some characteristic that imbues the good with a particular quality. Geographical indications are protected strongly for wines and spirits by TRIPS and ongoing negotiations at the WTO are aimed at deciding whether to extend this protection to other products, such as foodstuffs and textile designs.

Copyrights are exclusive rights for a period of time, typically life of the author plus 50 or 75 years, to make and sell copies of a literary or artistic expression. Such expressions may be music, books, magazines, plays, paintings and other forms of expression, but recently have been extended to software, data compilations, electronic goods, satellite transmissions and Internet content. Note that copyrights protect the expression of an idea, rather than the idea itself (as with patents). Thus one person's painting of a seashore does not prevent others from painting the same seashore. But each person's painting is protected from unauthorized copying.

Trade secrets, or confidential business information, are technologies such as chemical formulas, customer lists and management techniques

that firms use but do not make public. They must make efforts to keep these technologies secret in order to avoid losing them to the public domain. Rival firms are free to reverse engineer these technologies (since they are not patented) in order to learn them. Upon successful reverse engineering, rival firms may use the information as well. Trade secrets exist primarily to protect so-called sub-patentable inventions, while ensuring that rival firms must at least undertake legitimate reverse-engineering costs rather than being able to free ride completely. Laws protecting trade secrets are not literally IPRs because they do not define exclusive rights. Rather these laws define acceptable forms of competition in learning other firms' trade secrets. A particularly important form of trade secret is the protection provided by governments to confidential test data submitted to health authorities in order to achieve patents or marketing approval in pharmaceuticals and agricultural chemicals.

Administration. As a general matter, both low- and middle-income countries would benefit from greater flows of technical and financial assistance to implement and enforce IPRs. Poor developing countries also should push developed countries to meet their commitment to encourage technology transfer flows.[6] Those commitments have not met with much activity to date, raising concerns within developing nations about the balance of interests in TRIPS.

Regarding administrative issues, low-income countries cannot generally afford patent examination offices and should rely on patent registration. However information from international patent offices and databases is available to determine if patent applications were denied in other jurisdictions. Some countries could also gain from coordinating regional patent and trademark examination systems. Electronic access to international patent and trademark registries also cuts costs of performing examinations.

Application and renewal fees for patents and trademarks may be set to cover administration costs. Fees could be selected so as to promote desirable innovation and use of IPRs. It is possible, for example, to set lower patent application fees for small and medium enterprises than for large firms. Patent renewal fees should rise over time to encourage rights holders to let protection lapse on less valuable inventions, thereby moving technologies into the public domain.

Patents. Consider next encouraging domestic innovation. Developing countries should require rapid (no more than 18 months from application) publication of patent applications (most of which will have been published elsewhere in any case), with full disclosure of the tech-

nical processes involved in making the inventions and reducing them to commercial practice. This policy should encourage local firms to invent around patents and use the disclosed knowledge to improve their manufacturing methods. Countries with a patent registration system should permit opposition procedures after grants are made in order to invalidate inappropriately awarded patents, while countries with examination offices could permit pre-grant opposition.[7]

Several patent standards can be beneficial for technology followers. Least developed countries should adopt broad exemptions from patentability. It seems particularly important to reserve medical techniques, higher order life forms and new plant varieties (seeds) in the non-patentable domain. While computer programmes cannot be subject to a blanket exemption, high standards of non-obviousness and novelty could remove some software from the patent realm, thereby preserving possibilities for reverse engineering. Developing countries could also permit oral prior art (which refers to traditional knowledge of how a medicine can treat a disease or similar items handed down orally) to defeat claims of novelty. They could also provide a limited grace period in order to expand the inventions available in the public domain. Authorities could also sustain the rights of prior users of newly patented inventions to continue to use them with appropriate licence fees.

For patents countries could set high standards for the inventive step, thereby preventing routine discoveries from being patented. Similarly, a rigorous utility standard would prevent basic scientific results from becoming patented, as has happened increasingly in the United States.[8] Regarding patent scope, countries could exercise strict claims and discourage multiple claims in patent applications. Countries should set a narrow doctrine of equivalents, setting out conditions under which infringement is found on use of similar technologies and products. They may also set exemptions to exclusive rights in order to promote learning and diffusion. For example, permitting private, non-commercial use for limited purposes can improve information dissemination. To illustrate, a recent WTO panel ruling validated Canada's practice of permitting generic drug firms to use patented technologies in the development of competing products.

Finally, under circumstances set out in article 31 of TRIPS, governments may issue compulsory licences to promote the public interest in health, welfare and security. Compulsory licensing processes need to be transparent in order to avoid discouraging entry of foreign firms

and introduction of new technologies by domestic firms. Compulsory licences are available also to restrain monopolistic behaviour.

It is sensible for developing countries to provide utility models (or "petty patents") in their patent systems because they can promote local innovation and adaptation that is important for domestic competition and learning. Similarly, narrow industrial design protection can promote innovation. Firms often compete on the basis of new designs, but these may be easily copied without some form of exclusive rights. Even at low levels of development competition on the basis of product design is common. Important examples include apparel and textile designs and ornamental designs for construction tiles. Thus providing rights to registered designs with a small novelty requirement can promote product innovation. These design rights may be supplemented by protection under copyright law, even without registration. Countries could also experiment with systems in which, after a short defined period of exclusivity, competing firms would automatically be able to pay for licences to use the designs in their own work.[9]

Protection of plant varieties is required by TRIPS, either through patents or an effective special system of plant breeders' rights. When establishing such rights poor countries would be advised to follow the UPOV 1978 model, providing a farmers' privilege and a wide exemption for rival breeders to use protected seeds to develop their own strains.[10] Public agencies in agriculturally based developing countries could place priority on investing in research and disseminating new seed varieties. Middle-income economies have seen the development of domestic plant-breeding sectors, and there are potential gains from stronger private rights—for example, as set out in UPOV 1991. Overall, however, given the importance of seeds as agricultural inputs, governments may need to be involved in procuring and distributing new varieties and may also participate in international seed deposit institutions, research laboratories and extension services.

In biotechnology, lower income economies should recognize only narrow patent claims and retain maximum exemptions from patentability where TRIPS allows. Countries with sophisticated industries, such as China and Brazil, might award stronger protection to promote technology transfer and domestic invention. Countries need efficient methods for regulating access of firms to domestic germplasm, genetic resources and other biological materials. Such materials are part of the national endowment and properly viewed as exhaustible resources. Effective con-

tracts need to be developed for sharing both commercial rents and the technical knowledge that emerges from their use.

Trademarks. Countries should recognize that efficient and transparent trademark protection can promote domestic product development and entry of new firms. In developing countries it is often domestic entrepreneurs who are frustrated because their trademarks are infringed by inferior products. This problem raises confusion on the part of consumers about the inherent quality of commodities they wish to purchase. Thus recognition of trademarks can be an important development spur, even for low-income countries.

Geographical indications should be of great economic interest to numerous developing countries. Such indications reflect the quality characteristics of products coming from a particular location. Several names, such as Basmati rice and Darjeeling tea, have been appropriated by others due to prior inability to register and protect them. Because many poor countries have a comparative advantage in agricultural products and processed foods and beverages, significant gains could be realized from registration of such place names. Indeed this is an area in which developing countries might prefer to advocate extended global standards.

Traditional knowledge, including folkloric arts, designs, traditional remedies and use of genetic resources, could be protected by a combination of copyright and trademark principles. Some experts argue for a special form of "traditional intellectual property" rights ("TIP rights") that would operate more like patents (Cottier and Panizzon 2005). A major problem is that traditional knowledge is often collectively held among many villages and regions, suggesting that property rights would effectively remove them from the public domain. Appropriate standards for protecting such knowledge and earning economic benefits from it are still evolving through experimentation and legislation.

Copyrights. Copyright protection can promote cultural development and permit creators to earn economic returns. Substantial anecdotal evidence suggests that artistic creation is discouraged in environments with widespread copying, affirmed by studies in Jamaica and Indonesia (Luthria and Maskus 2004). For example, development of a recorded music industry in African countries likely is constrained by extensive copying and unauthorized use of music.

A distinction should be made between piratical duplication of published and recorded goods and imitation to gain access to new information. The former activities are profitable in the short run but

do little to improve the technological capabilities of copying nations. More important in the long run are policies to reduce the costs of access to information and electronic technologies that promote economic and cultural progress. Developing countries may complement their copyright regimes with mechanisms favouring diffusion and learning. For example, they should maintain the minimum required terms of protection to accelerate the introduction of information goods into the public domain. Furthermore, countries may explicitly permit reverse engineering of software, which permits decompiling computer code to develop new applications and copying the functional components of programmes. This approach would be effectively complemented by encouraging the use of open-source software. And countries should build an institutional framework to promote their copyright sectors, including offering effective enforcement against piracy, establishment of collection societies and identification of copyrightable works of national origin.

It is important to recognize that countries are free to determine the fair-use exceptions they will permit in the copyright area (Okediji 2005). Copyrighted materials may be made available on a limited and non-commercial basis for use in education, research, libraries, museums and charitable organizations. The preamble to the 1996 WIPO Copyright Treaty contains language promoting this balance of interests and encouraging nations to carry forward such limitations into the digital network environment. In this regard developing countries should be wary of implementing laws that broadly define illegal activity in terms of circumventing electronic protection of educational and research materials.[11]

TRIPS requires copyright protection for data compilations. The European Union has moved far beyond TRIPS in setting out patent-like protection for databases, even when their development involves little or no creative step. Developing countries should insist on a demonstration of significant creativity before recognizing such protection.

Trade secrets. Recognizing the need to protect trade secrets can spur competition, and an appropriate regime for protecting confidential business information is important for attracting innovative firms. A natural lead time is provided to owners of trade secrets because rivals must invest in learning the technical information they embody. This investment contributes to the technical knowledge of an economy and encourages follow-on innovation. Rival firms may prefer to acquire trade secrets by purchasing licences from the originator, thereby paying some share of the invention costs and raising incentives for future inventive

activity. Trade secrets are also instrumental in encouraging technology transfer from abroad (Maskus 2000).

Governments are obliged to take steps to prevent the unfair disclosure of confidential test data submitted for approval of medicines and agricultural chemicals for some period. Developing countries could establish a high standard for what constitutes a new chemical entity and deny such protection to simple reformulations or repackaging. Some scholars argue that authorities must keep test data secret, except where disclosure is required for public health purposes, but may use the data for subsequent approval of generic substitutes. Argentina has implemented a law under this interpretation, which could become the standard approach among developing countries. Others believe that countries must provide a formal exclusivity period, during which use would be prohibited. If so, poor countries could tilt the balance towards competition by providing only a limited period in which a prior applicant's test data may not be used.

Deploying other policies to acquire information

The approaches discussed above can help encourage competition and innovation, but are insufficient for this purpose. By themselves IPRs cannot ensure more innovation, technology transfer and growth in developing countries. Intellectual property protection is only one component of a broad approach to business regulation, innovation promotion and consumer protection in an effective overall system (Maskus 2000).

Human capital development. A critical complementary factor is a commitment to education, training and skill development. The positive role of educational attainment in economic growth is well established. And although not established, it seems likely from results reviewed above that a positive relationship exists between the strength of IPRs and the level (or growth) of human capital.

Liberal market access. Economies that are more open to trade and investment seem to experience more growth from strengthening their IPRs relative to closed economies. Stronger property rights create market power, which is more easily abused in closed economies. For example, a patent confers greater market power in the presence of an import quota on similar goods. Competitive markets help limit the effective scope of IPRs to their intended functions of encouraging investments in new products but not preventing entry.

IPRs and open markets are complementary policies for other reasons. First, a liberal stance on inward trade and foreign direct investment improves a country's access to international technologies, intermediate inputs and producer services. These flows seem to be discouraged by weak patents. Second, IPRs can encourage investments in improved product quality, which is important for breaking into export markets.

Antitrust policy. Because there is scope for abuse and anti-competitive practices in the exploitation of IPRs, countries need to establish competition rules to discipline such practices. A number of complex competition problems are potentially raised by the exclusive use of IPRs. For example, horizontal restraints among competitors through licensing agreements might fix prices, limit output or divide markets. In addition, patent-pooling and cross-licensing agreements between competing firms may reduce competition in downstream product markets. Further problems include exclusionary licensing, which could exclude other firms from competing in particular markets by raising barriers to entry, and tied sales, giving a licensor dominant position in a market for which it does not have intellectual property protection. Similar problems emerge if licences are required only to use the licensor's technology, including future technologies, and if licensors restrict the development of competing technologies by licensors through exclusive grant-back provisions and exclusivity arrangements.

The complexity of such issues may be recognized from the fact that antitrust authorities, even in developed economies, have found it difficult to establish consistent principles covering abusive licensing agreements. Still, maintaining an economy subject to active competition processes is likely to be the most effective means of disciplining potential IPRs abuses.

For example, an important form of competition policy is the exhaustion regime, which determines the legality of parallel imports. An open regime of parallel imports (that is, a policy of international exhaustion) makes sense, but two concerns arise. First, parallel imports may discourage local distributors from investing in advertising, product warranties and customer services. As a result some markets may not be adequately served, harming consumers in the long run. Second, in principle restraining parallel trade permits IPRs owners to engage in international price discrimination, which may encourage firms to sell products in poor countries at lower prices. To date, however, there is not much evidence to support this theory, even in products subject to considerable parallel imports where they are legal.

From these comments it seems that developing countries generally should maintain open markets in order to buy goods and technologies from the cheapest suppliers. One significant exception arises in the case of poor countries that receive medicines from abroad at cheap or subsidized prices. To encourage such cheap distribution, recipient countries should agree to prevent re-exports of goods provided through such channels.

Technology infrastructure. To be effective IPRs should be supplemented by programmes to support technology acquisition and national technical change. Indeed by themselves patents, copyrights and trade secrets simply provide a supporting mechanism for broader innovation and diffusion processes. Developed countries and many higher income developing countries have extensive infrastructural systems, including public grants to basic science, tax advantages for applied research and development in the private sector and extension services in the use of agricultural technologies. Governments also provide incentives for the commercialization of research results and encourage collaboration between private and public enterprises.

Such policies could be usefully adopted in many lower income countries if tailored to specific circumstances. This conclusion must be qualified by noting that there are opportunity costs in allocating budgetary resources to innovation programmes. The social returns to technology development in the lowest income countries likely would be small compared with gains from improvements in primary education, water systems and other pressing development needs.

Still, to the extent that investment in product development and the entry of new firms is inadequately encouraged by the private market or by policy restraints, there is a rationale for public assistance and policy reforms. Poor innovation could be due to such factors as an inadequate environment for taking risks, taxation systems that do not treat research and development as a business cost and missing information about technological opportunities. Policies could aim to relax such restraints, which could be particularly important for small and medium-sized enterprises—the source of much innovation in developing countries.

Global initiatives for generating and sharing information

Turn next to the question of deploying global, or multilateral, policies to improve the situation for developing new information and improv-

ing access to it on the part of developing countries. An initial question is whether further policies and coordination are necessary.

Arguments for multilateral intervention

Drawing together the observations in this report, one can identify at least six arguments for strengthening or reforming the international system for dealing with information externalities and market or policy failures.

Knowledge and information are public goods with a strong global dimension. They have two peculiar and dominant factors as a particular form of public good. First, incentives to develop new technologies and information may be limited by free-riding problems in the absence of public interventions to exclude second users. Differences in economic interests among countries suggest that the global situation would involve endemic free riding in the absence of some coordinated global policy, such as the TRIPS Agreement. Second, and somewhat in conflict, because it can be transferred at low cost, sound public policy should aim at the broadest possible diffusion of scientific, technical and cultural information. The classic static versus dynamic policy externalities arise even more at the global level and call for careful consideration of trade-offs across the interests of multiple nations.

Markets for trading technology and information are inherently subject to failure, and these failures are likely to be more severe in international technology transfers. One such failure is the result of asymmetric information. Technology suppliers cannot fully reveal their knowledge without destroying the basis for trade, while buyers cannot fully determine the value of the information before buying it. This problem can lead to large transactions costs and stifle technology flows. In the international context information and contract enforcement problems may be severe. A second is that developers of new technology may have significant market power, depending on lead times and the nature of IPRs. This market power helps compensate inventors for research and development costs but generates inefficiencies in the use of information. A third is that technical information may spill over into wider use in free-riding countries without any compensation or contribution to costs of research and development on the part of local firms. For these reasons international technology transfers may be significantly less than globally optimal.

IPRs regimes are liable to remain at variance because different countries have quite distinctive interests in protecting new information. For ex-

ample, the United States pushes for "TRIPS-plus" standards in bilateral trade agreements despite the dubious prospect of any gains for its trading partners. For their part, poorer developing countries are unlikely to devote scarce development resources to enforcing IPRs where the beneficiaries are foreign, while the costs would be borne by the domestic treasury and result in limited domestic imitation prospects. Neither situation is likely to benefit the global economy.

The successive strengthening of IPRs within both developed and developing countries, as required by TRIPS and other agreements, promises to raise barriers to the affordable provision of basic public goods. This includes basic knowledge and science, public health interventions, educational inputs, agricultural technologies and environmental protection.

The global system for generating, protecting and disseminating information is fragmented, with various parts aiming at different objectives. Some parts are specific interventions aimed at perceived needs, such as public-private partnerships in medicines development and seed banks. Some are global responses that exist to protect the rights to trade intellectual property, such as TRIPS and TRIPS-Plus. However, these different approaches may leave policy-makers confused about whether and how to take advantage of policy flexibilities in setting domestic IPRs policies. Moreover, there is little coordination among these various approaches, which may be inefficient in several dimensions and cause legal ambiguities.

The system is aimed more at requiring certain standards and restraining government policy choice than at encouraging global innovation. In short there is no "transnational innovation system" that could focus on global needs.

An international institution for knowledge would be unworkable

Is there a need for a coordinated, multilateral institution aimed both at providing incentives for developing new knowledge that can be deployed to deal with GPGs and at disseminating the information at low costs to all users? Because problems are so variable and differ so much at the national and international levels, such an overarching institution would be counter-productive. In addition to the evident bureaucratic costs, it seems unlikely that a centralized institution would be sufficiently attuned to the needs of specific countries in the areas of IPRs regulation, antitrust and local environmental and health needs to offer much more than technical advice. Such advice is already available, though fragmented, from such institutions as WIPO, the World Bank and WTO.

Such a centralized institution might, in principle, receive the task of collecting and providing funds for research into GPGs needs. While there may some value in recommending such an approach, a global "grants agency" would suffer from considerable problems. First, it would inevitably duplicate efforts of national research agencies such as the National Science Foundation and National Institutes of Health in the United States. In most areas of technology the issue has less to do with funding than with convincing national agencies to re-allocate research expenditures towards public goods with international dimensions. A major exception appears to be essential medicines, where more efforts are required to devote public resources to research. However it should be feasible to designate the WHO as a central agency for that purpose.

Second, a more significant reason for doubting the effectiveness of a global institution is simply that it might allocate research resources in part for political purposes, depending on the pressures brought by donors and members. Peer review of grant proposals and spending programmes might be more difficult to organize on a global scale. Thus this report does not recommend establishing a global "grants agency". The issue is whether another kind of organization, possibly an existing one, can help set standards, coordinate policies and monitor and evaluate performance.

Overview of existing institutions

Before discussing suggested policy changes, it is useful to overview the existing international institutions aimed at dealing with incentives for generating and distributing information. An assessment will be provided of whether these institutions are well structured for the overall purposes of dealing with market failures and global externalities in information transactions. Also considered is whether they are capable of serving as a central point of gathering and sharing information, setting standards and monitoring and evaluating performance.

World Intellectual Property Organization. The WIPO is a specialized UN agency charged with facilitating the international exploitation of intellectual property. It has essentially four tasks. First, it maintains most of the conventions dealing directly with international registration and protection of IPRs. Among the major ones are the Paris Convention (industrial property), Berne Convention (copyrights), Patent Cooperation Treaty (patent applications) and Madrid Protocol (registration of trademarks). WIPO collects registration fees on international patent

applications and trademark registrations through the Patent Cooperation Treaty and Madrid Protocol, which are the agency's main source of revenues. In total there are 23 international agreements maintained by WIPO, including conventions on domestic standards for protecting intellectual property, international registration protocols and classification systems.

Second, the agency serves as a negotiating forum for nations interested in revising these conventions or developing new international agreements. For example, both the Paris Convention and Berne Convention have been updated numerous times in recognition of the need to change protection as technologies evolve. Two new copyright conventions were negotiated at WIPO in the late 1990s, the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty. These so-called "digital rights treaties" are supposed to facilitate copyright protection in a world of electronic products and online communication. In 2000 a WIPO diplomatic conference adopted the Patent Law Treaty, which harmonized and streamlined applications and revocation procedures in order to reduce transactions costs of applicants. Several countries currently are negotiating an additional harmonization of patent standards through the Substantive Patent Law Treaty. This agreement would require contracting parties effectively to harmonize fundamental patent standards, including the definition of prior art, novelty, non-obviousness, utility and sufficient disclosure rules. It is controversial because many observers believe it would significantly restrict the flexibility in patenting afforded developing countries by the TRIPS Agreement.[12] To date these negotiations have failed largely because of an inability of developed countries to agree on basic standards.

Third, WIPO has a technical assistance function, which consists principally of developing model IPRs laws and encouraging developing countries to adopt such laws. It also provides education and training for IPRs officials and judges. Many scholars and non-governmental organizations are strident critics of the agency because efforts have been aimed at imposing developed country standards on poorer countries. Thus WIPO is currently under considerable pressure to reform its procedures and adopt a development agenda that would encourage developing countries to avoid strong and harmonized IPRs, especially patents, in favour of adopting the flexibilities available in TRIPS.[13] WIPO is in a difficult position because its mandate as a specialized UN agency is to improve global standards of intellectual property protection. It traditionally has interpreted this as "strengthen", which is not surprising

because its major financial supporters are the developed economies that produce most of the world's intellectual property.

For a long time WIPO served as a backwater among international agencies, with the sole functions of facilitating the negotiation of technical treaties and managing international patent and trademark applications. Although IPRs have become intensely controversial in the global economy, raising pressure on the institution, its mandate has remained essentially the same.

WIPO has some advantages. First, it has considerable institutional expertise in the legal aspects of IPRs and is the only agency that retains centralized information about the laws and practices of developing countries. Second, it has a history of facilitating negotiations on setting standards for IPRs. Third, it has dedicated sources of revenue (international patent and trademark applications) that could be allocated at the margins towards improving national administration systems in ways that would promote development.

But WIPO could not be reformed to serve effectively as a lead agency for information. Its many significant disadvantages are difficult to surmount. First, its mandate and history have been focused solely on the narrow questions of formulating laws in IPRs. It has no experience in the broader questions of encouraging markets in innovation, supporting international technology transfer or generating knowledge. Put differently, the agency takes an intensely legalistic approach to the particular problem of IPRs institutions and reforms, with little ability to consider broader economic or scientific questions. It has no history of evaluating policies across countries in terms of their abilities to affect technology diffusion or learning, nor does it have expertise in economics, business or engineering that would allow it to compile appropriate information on licensing contracts. For example, it would not be in a position to analyse or identify the appropriate scope of technology subsidies in middle-income countries.

Second, WIPO's operations to date have been dominated by the economic interests of major intellectual property–producing nations and enterprises. Despite recent attempts to inject a development agenda, there seems little likelihood that the policy domination will be influenced, in part because WIPO is funded by fees on applications overwhelmingly registered by enterprises in developed nations. More fundamentally it faces significant distrust on the part of many major developing countries (such as Brazil, Argentina, Thailand and India) because of its focus on encouraging standards harmonization at developed-country levels.

Third, as a single-issue agency its negotiations over standards bear little scope for significant policy trade-offs among countries in terms of economic interests. That is its negotiations are limited to particular (albeit complex) areas of IPRs regulation in which developing countries may have relatively little to gain in the medium term but are significantly pressured to agree to reforms. Those countries would have more to gain if they were able to exchange IPRs reforms for other advantages, such as market access, additional worker visas or financial assistance outside IPRs. Therefore agreements reached tend to be limited in scope and often do not achieve a widespread feeling of ownership by poorer nations.

Overall WIPO can play a useful role in setting some narrow standards in IPRs and in serving as a clearing house for information about national laws. It is unlikely to be able to serve as a central agency regarding broader areas in the economics and science of information markets.

World Trade Organization. The WTO has multiple functions relevant to this chapter as well. First, it has a small secretariat that facilitates the negotiation of multilateral trade agreements among member states. These agreements include the General Agreement on Tariffs and Trade (GATT) (covering trade in goods), GATS (trade in services), TRIPS (intellectual property) and other more specific accords. Second, the understanding on dispute settlement provides a framework for countries to resolve disputes regarding the application of trade rules and regulations in one nation that might nullify or impair the negotiated access or other benefits of firms in other nations. Perhaps its most important distinguishing characteristic is that this framework sets out binding conditions for dispute resolution. Few other multilateral agencies are able to require compliance (in some way) with its rules and interpretations. Finally, it also has a significant technical assistance programme to help developing countries improve technical standards, facilitate trade, manage subsidies and the like.

Most important is that WTO agreements contain many requirements and disciplines that affect the development and trade of information. Trade policies are relevant and reductions in tariffs and restrictions on foreign direct investment may be expected to raise implicit and explicit technology transfers. More directly, the subsidies agreement places restrictions on the ability of countries to deploy industrial policies through industry-specific commercial subsidies to research and development. The agreements on product standards (sanitary and phytosanitary standards and technical barriers to trade) also affect the willingness

of firms to make technical changes through government adoption of certification requirements and the like.

Most relevant is the TRIPS agreement, which is meant to reduce barriers to trade and investment by protecting the rights of inventors and creators to exploit their products internationally without undue concern about illegal infringement and other unauthorized uses. TRIPS may be expected to increase global incentives for research and development, though over the medium term such increases will be predominantly in developed countries that already produce the bulk of intellectual property. The agreement might also improve prospects for international technological diffusion, though conditions under which this outcome may pertain are complex and uncertain (Hoekman, Maskus and Saggi 2005). It remains to be seen whether TRIPS establishes a sensible balance among the needs of various participants in information development and trade.

As structured, the WTO offers considerable advantages as an institution for dealing with global information problems. First, the integration of a comprehensive TRIPS agreement with the broader WTO accords recognizes that the generation and transfer of technological information are importantly related to trade. Thus there is a framework in place for treating the international commercial aspects of government policies regarding information in an integrated way.[14] Second, the WTO has competency over a large range of commercial policies, including market access in goods and services and, technological and product standards, and subsidies. Thus far more scope exists for beneficial cross-issue bargaining in the context of standards setting. Third, TRIPS is subject to the dispute settlement understanding, so that the WTO is also the only institution with binding powers to discipline derogations in government policy regarding IPRs. Fourth, although the secretariat is small, it does have a staff of economists engaged in monitoring and reviewing trade policies and IPRs policies. Thus it is building a base of information about the nature of such policies in its member states and has some potential for analysing their effectiveness. It should be feasible to add the objective of gathering information on how national technology policies have served to improve (or worsen) prospects for information flows and to publicize the parameters of successful prior licensing contracts.[15] These features together suggest that the WTO already is able to manage many of the problems of information markets. But taking advantage of this position would require additional resources for the institution.

This argument falls short, however, when one considers that the WTO necessarily is devised as a set of limitations or disciplines against government actions that interfere with trade. Thus in TRIPS governments are required to set minimum standards for protecting intellectual property—failing to do so might invoke complaints from other member states. Similarly, provisions of the subsidies agreement limit the kinds of fiscal interventions governments may undertake on behalf of their industries. The WTO is therefore an institution inherently aimed at limiting government action rather than encouraging policy experimentation. Moreover, with few exceptions WTO agreements do not limit the actions of private firms, nor do they support coordinated intervention on behalf of beneficial private activity. Most fundamentally, WTO rules are aimed at preventing governments from interfering with commercial competition and have little to say about the active provision of basic GPGs, such as scientific knowledge, public health and environmental protection. To be sure, multilateral disciplines may limit policy space in these areas for specific countries, but agreements do not set out conditions for encouraging their global coordination.

Overall, then, the WTO should be an important contributor to improving the international exchange of information and knowledge through further cross-issue negotiations and, especially, through information gathering and policy coordination. It would, for example, be the appropriate forum for negotiating changes in subsidy policies that restrict the ability of developing countries to deploy effective technology interventions. This could be an effective information-based counterpart to the spirit of the Doha Declaration on Public Health, which recognized the need for the WTO to reduce the scope of patent protection for essential medicines in poor countries.

However the WTO is (at present) limited largely to the realm of commercial policies and can do little to facilitate exchange of basic knowledge or encourage its use for public goods. Moreover, it has little scope for promoting scientific collaboration. The organization is not fully suited to serve as a lead agency for improving the creation and use of global information. Indeed, without a significant increase in resources and scope, to expect it to move beyond its commercial-policy focus could risk overloading an already heavily burdened institution. Nonetheless, the final section offers one proposal for using WTO mechanisms to help improve access to basic knowledge.

World Bank. The World Bank plays a significant public role in information. Indeed it often refers to itself as a "knowledge bank".[16] Some

of its lending programmes are aimed at improving national innovation systems through expanding educational facilities, funding scientific laboratories, encouraging commercialization incentives in government policies and so on. It invests heavily in information technologies and infrastructures in developing countries. It has extensive research programmes that analyse barriers to the use and transfer of information. These research efforts have generated massive amounts of data and understanding about problems in international information markets and regulatory policies. The Bank attempts within its constraints to disseminate this knowledge as widely as possible, including through the Internet. It offers extensive technical assistance to developing countries in terms of policy implementation and administration.

The World Bank already is a major repository of information and data about how national and global markets for information function and fail. It is heavily involved, for example, in analysing and advising governments on trade and investment policies that have important effects on the international exchange of information. Within their broad range of expertise, staff consider virtually every sector and policy issue that loom large in the information area, including information technologies, Internet and telecommunications, education, agriculture and health policy. Indeed the essential advantage of the World Bank relative to other agencies is that its very need for information and analytical knowledge across the spectrum of economic and development issues means that it is not functionally constrained in the same way that the WTO is. A second very significant difference is that the World Bank is capable of working directly with private enterprises, including non-governmental organizations, rather than being limited to contact with governments or public agencies. It would be well positioned, for example, to gather details about successful technology transfer contracts from multinational enterprises to establish a useful database regarding appropriate policies and contract terms.

For these reasons the World Bank is the best institution for meeting the international need for a lead agency for knowledge GPGs. It already has significant analytical and professional resources, which could be brought together into a functional coordination group for global information management and dissemination.

Other agencies. Two other UN agencies may be mentioned briefly. The WHO plays some role—though quite limited—in the international procurement and provision of essential medicines for developing

nations. It largely is limited to providing information, certifying the effectiveness of certain drugs for particular conditions and providing technical assistance on the ground in public health. If there is to be a significant increase in incentives for developing new medicines for neglected diseases in poor countries, presumably the WHO would play a central role.

UNESCO aims to promote cooperation among member states in science, education, cultural development and communications, acting as a clearing house for information. In principle its objectives are similar to what might be anticipated of a multilateral "knowledge agency". However it has no real policy competence and only limited mechanisms for diffusing information flows internationally. Moreover its mission is focused more on providing basic education services and promoting cultural industries than on managing information. To serve as an effective international body for managing information UNESCO would require a significant increase in its capacity for analysis and setting standards. It is doubtful that those agencies with standards-setting competencies (WTO, WIPO and perhaps WHO) would be willing to cede such abilities, while it seems there would be little additional return from investing UNESCO with them.

Other agreements. There are other international agreements that serve partially to deal with knowledge issues. For example, the CGIAR is an association of public research laboratories (affiliated with the World Bank) that perform research on agricultural technologies (new strains of wheat, rice and other crops) that achieve certain functions (stalk strength and pest resistance) and may be fruitfully applied in developing countries. Under their guidance, the "Green Revolution" continues, though perhaps at a less spectacular pace than in the past (Evenson 2005).

The International Treaty on Plant Genetic Resources for Food and Agriculture entered into force in 2004 and has 55 ratifications. It establishes a kind of limited common property of 64 major food and feed crops held in government and international seed banks. Private parties that use materials from this system as inputs into commercial products must pay a percentage of profits to a trust account, which will be used to promote benefit sharing with source countries and conservation of plant genetic resources (Helfer 2005). The treaty is the first binding international agreement to protect the public-domain status of genetic materials and to create a funding mechanism for preserving the agricultural commons. There remain several ambiguities in how the treaty

will permit private agents to register IPRs on the technologies they develop from this common resource, however, and a number of major agricultural producers have not ratified it.

Another agreement is the Convention on Biological Diversity, which recognizes the rights of sovereign states to control the genetic resources within their borders and regulate their extraction through access laws and bilateral contracts to ensure benefit sharing. Such agreements are important in light of the considerable and growing interest on the part of seed companies and pharmaceutical and biotechnology firms in developing the chemical properties of natural resources (plants, fish) into usable products. As has been widely discussed, however, the provisions of the convention are, in some dimensions, in conflict with the private rights set out in TRIPS and with the patent regimes of most high-income countries. To date there has been little effort to reconcile these differences.

Finally, it should be noted that a number of public-private partnerships have emerged in pharmaceuticals to develop new medicines and vaccines for treating the diseases of low-income countries, including malaria, leshmaniasis and HIV/AIDS. Prominent examples include the Medicines for Malaria Venture, the International AIDS Vaccine Initiative and various projects of the Bill & Melinda Gates Foundation. The objective of such partnerships is to allocate funds from foundations and public sources (such as the Global Fund to Fight AIDS, Tuberculosis and Malaria) to cooperative public and private research groups developing new medicines for targeted maladies. These initiatives have made headway in the past five years, and a number of important programmes are under way. But by most accounts the overall problem faces serious funding shortfalls (Kettler and Towse 2001; Abbott 2005; Sachs 2005). Much remains to be done in terms of developing vaccines and other breakthrough technologies.

Policy proposals

A centralized institution for global knowledge likely would be unworkable. But a number of reforms at the global level could significantly improve the international use of information and raise development prospects. This chapter concludes with a list of suggestions, ranging from least interventionist (and most feasible institutionally) to the most wide ranging (and probably less feasible).

Dedicated revenues from international intellectual property rights

A first proposal is that some share of the fees generated by international patent applications in the Patent Cooperation Treaty and international trademark registrations in the Madrid Protocol be set aside for two specific uses. The first would be to help defray the costs of administering and enforcing IPRs in low-income countries. The logic of this proposal is straightforward. Stronger intellectual property protection in developing countries will demand the investment of scarce development resources to training, administration and enforcement. Nevertheless, in the medium term, the major beneficiaries of these investments will be IPRs registrants in foreign countries, overwhelmingly from the United States, the European Union and Japan. In principle these beneficiaries should be required to pay some portion of the costs of improving their market opportunities. At the same time, because there will be relatively few (and probably not well organized) domestic beneficiaries in low-income countries, the commitment to absorb the costs from domestic public resources is liable to be weak. Indeed it is questionable whether governments in poor countries might be expected to allocate scarce development resources to the enforcement of IPRs in any event, given the significant other needs placed on them.

The second use would be to provide resources for investing in education, human capital development and scientific infrastructures in developing countries. One significant impediment to the adoption and modification of technologies for local use is the absence of public and public-private research laboratories in developing countries, including extension services and distance learning. Investments in national and regional innovation systems can have significant social and economic pay-offs.

International patent and trademark application fees represent a ready source of income for these purposes. It should be noted that because these fees are the main source of income for WIPO, there would be institutional objections to implementing such a scheme. Two answers to such objections may be fruitfully raised. First, the fees could be raised to reflect the increasing value of international IPR protection. Moreover, higher patent fees in particular would tend to reduce pressures to patent globally, pushing technologies more rapidly into the public domain in developing countries. Second, the practice of funding WIPO through dedicated fees is, in itself, inefficient as a matter of global governance. Not only does it establish resistance to change, it also permits the agency to perpetuate structural inefficien-

cies by virtue of there being little need to compete for funding within the UN system.

Moratorium on further global harmonization of intellectual property rights

Maskus and Reichman (2004) have argued that it is time to take off the global table the exercise of setting stronger international standards and further harmonizing IPRs. The essential reason is that there remains substantial uncertainty about how the new regime, as embodied by TRIPS and TRIPS-plus standards, will affect processes of information generation and use in both developed and developing countries. The fact that IPRs interests in the United States and European Union wish to harmonize patent standards at strongly protective levels through the Substantive Patent Law Treaty does not mean such an approach would benefit developing countries. It is also premature to extend globally such developed country protective devices as EU database protection, US restrictions on fair use in electronic transmissions, software patents, plant variety patents, patents on life forms and lengthy protection of confidential test data.

Rather, we are in a time where it seems important to allow nations to adjust to the new regimes they have adopted and fit them into national and regional systems of innovation. IPRs are effective in generating innovation and diffusing information only where market processes are competitive and domestic institutions and firms are capable of learning and adaptive innovation. Moreover, public health authorities and others charged with procuring public goods need to retain basic abilities to counter possible excessive costs of IPRs. These critical processes are still available under TRIPS, but ongoing discussions and implementation of TRIPS-plus standards are whittling their scope.

Countries at various levels of development should have some space to experiment with linking IPRs to broader innovation and development policies.[17] This experimentation could have the benefit of discovering competitive approaches to policy that could be deployed even in developed countries concerned with increasing privatization of rights to knowledge. Experimentation along these lines could involve such ideas as combining open-source innovation models in software and biotechnology at the invention stage with well defined and limited IPRs at the output stage. It could also involve the use of so-called "liability rule" regimes for small-scale innovations. Firms would pay licence fees to take advantage of technologies available in a common pool for de-

veloping their own versions of a new product. Such a semi-commons approach ensures that all rival firms would pay some portion of the joint costs of developing and improving the kind of smaller innovations and differentiated products that have characterized technical change in the past in developing countries.

A potential exception to the moratorium would be to continue discussions and negotiations within the WTO on extending protection for geographical indications beyond wines and spirits to location-based agricultural goods and artisan goods. Geographical indications bear some potential for promoting value-added product differentiation in developing countries and could be useful in some contexts.

Initiatives to improve international technology diffusion

A key feature of an effective global information system is increasing access to international technological flows. Much information crosses borders through trade, foreign direct investment and other market-based forms of technology transactions. Some is made available in the public domain, though access to this information in low-income countries may be limited by weak telecommunications infrastructures or other difficulties. International access could be improved without unduly diminishing incentives for creating knowledge.[18]

First, learning by doing and labour movements among firms and institutions are important channels of diffusing technical knowledge. Greater international mobility of people could be important for this. To assist in the diffusion gains and innovation profiles of developing countries, international policies could encourage temporary movement of skilled and entrepreneurial individuals. The classic problems of long-term migration and the associated brain drain would not arise if labour movements were temporary and returnees applied new skills and knowledge at home.

Negotiations over the temporary cross-border movement of people are under way in the WTO through the GATS agreement. While GATS presently is limited to people providing services, its basic approach could be extended to personnel that relocate temporarily in order to increase their human capital and acquire new skills. This activity could be labelled trade in "training services". Such movements could be thought of as a means for host countries to export knowledge to developing countries. If this turns out not to be feasible, governments could negotiate a stand-alone arrangement under which developing

countries could be granted additional temporary visa allocations for working in developed economies, where such work would be tied to learning technologies, information and business techniques.

Second, donor countries and international organizations could consider establishing special trust funds for training scientific and technical personnel. Such funds could especially facilitate the transfer of technologies that are particularly sensitive for the provision of public goods and encourage research activities in developing countries. In general public authorities in developed countries could increase their efforts to assist developing countries improve their abilities to offer education and engage in scientific research, including through enhanced ability to access international information and the Internet. Given the World Bank's demonstrated abilities to manage trust funds and link research to improvements in communication, it may be most sensible to locate such activities in its purview to take advantage of economies of scope.

Third, to mitigate problems in trading technical information across borders, such international organizations as the WTO, World Bank, UNCTAD or UN Industrial Development Organization could serve as intermediary sources of knowledge about successful technology-acquisition programmes undertaken by various governments. The information provided in a central clearing house could include descriptions of successful international technology transactions, including reasonable royalty rates and helpful contract clauses for encouraging local technological innovation and adaptation.

A particular form of this suggestion would be for some institution (perhaps WIPO) to serve as an information source for expired intellectual property (and therefore in the public domain) and to collect donated patents and other forms of IPRs. These donations presumably would be made up largely of mature and semi-mature technologies that could effectively be deployed into production in poor economies.

Global public provision of sensitive public goods

Perhaps the central problem in encouraging institutions to research new medicines for diseases of developing countries is that the prevailing patent system, in conjunction with limited purchasing power in developing countries, fails to deliver appropriate incentives. It is unlikely that the adoption of stronger product patents in the developing world will shift this emphasis on its own merits. Indeed early evidence suggests that this effect will be slight at best (Lanjouw and Cockburn 2000). Anecdotal

evidence suggests, rather, that generic drug firms in India wishing to become international pharmaceutical powers are targeting their research programmes at "lifestyle" drugs and other medicines of greatest interest in high-income economies.

Optimal global policy should meet three criteria. First, giving lowest income countries access to existing therapies and drugs would require prices equal to, or in most cases below, marginal cost. In countries with low average incomes even a moderate price mark-up would generate a substantial deadweight loss. It would be better to separate incentives for development of future drugs from distribution of existing products. Distribution in lowest income countries should be founded on cost-based pricing, while the incentives for development of new drugs must be found elsewhere.

The second criterion is to limit coverage of inexpensive distribution to well defined and restricted geographical areas. The health policies of most developed countries must be isolated from the strategy for access to pharmaceutical drugs in lowest income countries. To avoid spillovers to the higher price OECD markets, the policy should include restrictions on re-exports of drugs into higher income countries. Thus, a regime of regional exhaustion within WHO-designated programme areas with tight controls to prevent low-cost drugs from escaping could generate significant access benefits.

Third, optimal policy must include incentives to encourage innovation and development of new vaccines, drugs and other therapies. The usual incentive for research and development of new pharmaceutical products is the prospect of future profits. But reliance on potential profits is not a workable incentive scheme for essential medicines. The potential rents are too small, and the political risks involved are too large. The solution is to design a mechanism with fixed lump-sum payments for new innovations, largely funded by developed countries, with a long-term guarantee that pharmaceutical companies will receive some reasonable return on their investment in new and effective drugs. These incentives could be complementary to various public-private partnerships mentioned earlier.

Both distribution and research payments would be costly, raising the need for a coordinated international fund, managed by an institution such as the WHO. The Global Fund is an important start in this direction. It has grown considerably in less than five years but still has not achieved its large targeted funding levels. Moreover, it is aimed solely at three of many potential diseases, though controlling them would be a remarkable accomplishment. Such programmes—linked with transpar-

ent information flows and medical and technical assistance—could do much to improve access to new medicines.

While the need for this kind of intervention is most acute in medical technologies, the same principles would apply to other public goods in which there are limited incentives to develop new products for low-income countries and distribute them cheaply. One example would be educational and scientific research materials, while another would be technologies to alleviate particular environmental problems. In each case there is an argument for centralized or regional purchasing incentives, combined with low-cost distribution systems.

Public access pools and differentiated access pricing

An alternative approach would be to encourage research institutions to collaborate in the formation of information pools to which research laboratories, inventors and firms could have access at some cost. This already occurs in a small way in the Treaty on Plant Genetic Resources. But a broader conception of public goods could be adopted to deepen and extend the approach to research results in medicine, agriculture, environmental inputs and other areas. Universities in the United States are beginning to collaborate on data exchanges under liberal licensing terms—an approach that could be extended internationally. Government research agencies could also consider exchanging scientific data and research results.

Because the development of such information is costly, access to pools may require some form of payments and guarantees that the data are used for specific purposes in the public or quasi-public arena, including education and follow-on research. Thus potential users may be charged licensing fees depending on their identity (public research institution, university, private firm), source (developed country, middle-income country, least developed country) and anticipated use. Depending on the nature of the technology, licence fees could be fixed sums or shares of sales or profits. This kind of approach could also help resolve problems of access and benefit sharing in genetic resources and traditional knowledge.

A treaty on access to basic science and technology

Since the Second World War the supply of GPGs has depended largely on public funding of scientific research and the sharing of data and results. In the United States, for example, major public agencies such

as the National Science Foundation, the Department of Energy, the Department of Agriculture and the National Institutes for Health have allocated massive amounts of funding to universities and other research institutions to develop new knowledge that later served as the basis for commercial innovation. For decades the bulk of the data and results generated were placed into the public domain for wider scientific and educational access. This subsidy to basic research is widely credited with generating the foundation for the astonishing pace of scientific and commercial innovation in the United States, with spillovers to other developed countries.

This fundamental policy in the United States and European Union has shifted towards the successive privatization of rights to exploit the results of publicly funded basic research. This has been done under a rubric of competitiveness, based on the claim that more basic science would translate into more commercial inventions with exploitable rents for domestic concerns. This approach has entered explicitly into US preferences for licensing to domestic interests (Barton and Maskus 2005). It has raised concerns about the creation of a "research anti-commons" in such areas as biotechnology, agricultural technologies and medicines. For example, patents offered on basic biomedical research tools and genetic sequences may prevent widespread development of products using them. This problem could be acute at the international level, where researchers and educators in developing countries have little leverage to enter into patent pools and information-sharing arrangements.

This situation has led some to call for a treaty on access to basic science and technology, negotiated under the auspices of the WTO.[19] This would place into the public domain the results of publicly funded research. The idea is to preserve and enhance the global commons in science and technology without unduly restricting private rights in commercial technologies. The agreement could encourage researchers from other countries to participate in, or compete with, local research teams for grants and subsidies, possibly combined with increased opportunities for temporary migration. It could also give researchers in other countries access to nationally generated science and data. It may be necessary to adopt a GATS-like approach to the treaty, permitting governments to reserve sensitive areas of technology and to designate different levels of commitment to open access.

The treaty would be best negotiated within the WTO for six reasons. First, without a multilateral agreement to discipline free riding, any bilateral or plurilateral agreement is liable not to be sustainable.

Second, the WTO already has responsibility for major agreements governing intellectual property, subsidies, standards and trade in services, all of which would be interrelated strongly with transfer of scientific results. Third, it offers a recognized format for arbitrating and settling disputes between governments, which would be primary players in this treaty. Fourth, it has a dynamic negotiating process that permits trade-offs in concessions across sectors and functional agreements. Fifth, it has become a focal point for the strengthening of national constituencies seeking the benefits of multilateral agreements. And sixth, many of the essential WTO principles may be applied to the treaty, as is discussed next.

In terms of format, several provisions would need to be addressed. The first would be its scope in terms of subject matter and processes. This chapter has used the term "basic" science and technology, but it is not easy to determine the dividing line between basic and applied research. In principle, one would describe basic knowledge as that which is truly non-rival and, by itself, has limited commercial utility. Examples are numerical formulas, algorithms, discoveries, surgical methods, research tools and genetic sequences. Note that such forms of knowledge are not patentable under most legal jurisdictions. Another class of basic technologies would be those supporting the provision of GPGs, such as environmentally sound processes and health care.

But there is no clear practical sense in which these characteristics might be defined. One way to manage the distinction would be to include research processes and results and data that are largely publicly funded, whether through direct research in government laboratories or grants to universities, non-governmental organizations or other institutions. Observe that this distinction between technological characteristics and funding may not be critical, because presumably most basic and public goods technologies require public financing in any event. Thus focusing on publicly funded research and data may be sufficient.

Another aspect of scope relates to the forms in which access is to be granted, or the nature of liberalization. In principle three levels of commitment could be entertained. First, "input liberalization" would permit researchers from other countries to participate in, or compete with, local research teams for grants and subsidies. This could be combined with increased opportunities for temporary migration of scientific personnel and additional student visas. But under this alternative, governments could choose to reserve their research results for preferential use by local firms and the registration of IPRs. While this approach could

expand research efficiency and transfer more skills abroad, its scope for raising access to new information would be limited.

Second, "output liberalization" would entail offering researchers in other countries access to nationally generated science and data, without increasing their ability to use underlying funding or research facilities. This approach would usefully expand the public commons and increase knowledge transfers but would not directly expand efficiency or transfer research skills. A key provision here would promote access to scientific databases and would ensure that intellectual property regulations not limit access to basic scientific knowledge.

Third, "full liberalization" would combine these approaches, both expanding international flows of research contracts and personnel and increasing global access to outcomes. Full liberalization is favoured to the extent that it is politically feasible. In getting there, however, it may be necessary to adopt something like a GATS approach, permitting governments to reserve sensitive areas of technology and to designate different levels of commitment to open access.

It is evident that a treaty of this kind would need to be balanced by safeguard clauses. One issue involved in international scientific and technological collaboration relates to the equitable and efficient distribution and management of intellectual property that could emerge from subsequent applied innovation. Another is that concerns of national security and technology proliferation would need to be addressed. For example, the United States has moved to establish new security classifications for biological data and restrict some foreign students from studying particular areas of biotechnology. Such restraints need to be balanced with the advantages of promoting the scientific and technological commons—a balance that could be set out in an international agreement.

It would also be possible to build-in certain preferential advantages for developing economies. For example, to the extent that data and research results are to be made available at some cost, differential pricing schemes for governments and institutions in low-income countries could be encouraged. Efforts to encourage research participation by scientists and engineers from developing countries could be written into proposal solicitations.

Two other issues arise for construction of a treaty on access to basic science and technology. First, careful consideration is needed of how its provisions relate to other WTO agreements and even such non-WTO accords as the Convention on Biological Diversity. Within the WTO, efforts to reconcile the treaty with TRIPS would be required. In effect

it would be an attempt to rebalance the strong privatization of rights in information implicit in TRIPS. Similarly, specification of the treaty could usefully sort out the meaning of pre-competitive research subsidies and how they might be provided internationally.

Second, there would need to be provisions for regular meetings, ongoing negotiations and a small secretariat or council to monitor and evaluate the extent of scientific and technological cooperation and its benefits.

The treaty would increase global access to the fruits of public research funding. An obvious difficulty is that research decisions are endogenous and funding might decline if authorities in the major countries perceive that it would dilute the ultimate economic benefits from such investments without reciprocal benefits from abroad. Thus analysis of national economic interests in the treaty is relevant for considering its construction and feasibility. Mutual trade liberalization in the WTO has been achieved through a mercantilist agenda in which countries were willing to offer greater market access to foreign firms in return for reciprocal access abroad. A similar reciprocity, in which access of foreign researchers to grants and research results is provided in return for related opportunities abroad, could appeal to competitiveness concerns. A broader scope of opportunities and research competition presumably would expand the efficiency with which public science and technology are generated, resulting in mutual gains from trade. And the opportunity to negotiate liberalization will focus the attention of those in the scientific and technological communities to press politically for the benefits of liberalization. Moreover, with a wider set of basic technologies available, largely in the public domain, the scale of product innovation built on such information should increase.

At the same time countries are highly asymmetric in terms of their abilities to finance and develop basic science and technology. The United States, European Union and Japan may see some complementarities in mutually integrating access to these resources. Some large developing countries such as Brazil, India and China could be attractive as well. But small developing countries with limited research resources offer little in the way of export interest to researchers in the main technology-developing nations. In consequence a WTO treaty might require technology importers to offer other, perhaps complementary, concessions in such areas as services, investment and product-market access. In addition the case could be made that firms in the poorest countries pose no competitive threat in the medium term and that permitting them to join on a preferential basis could help develop their research and innovation capabilities, in line with other development assistance.

There is another reason to think that an agreement may be supported by powerful economic interests. Unlike the situation 30 years ago multinational enterprises now often transfer technology in order to build export products in developing countries. The costs of doing so would diminish when local researchers have access to basic technologies and can effectively deploy them. Thus multinational enterprises might be expected to lobby for such an agreement, particularly to the extent that it could be accompanied by appropriate policy responses in recipient countries regarding governance and infrastructure. Further, the treaty would provide legal certainty about the scope of the public and private domain across countries, which would benefit global enterprises.

One should not minimize the difficulties that could arise in achieving such an agreement, however. A treaty on access to basic science and technology, essentially calling for multilateral access to the fruits of basic research funded (for the foreseeable future) in a relatively small number of countries, could encounter stiff political and economic objections.[20] Given the delicate nature of the issues involved and the need for accommodating cross-country and cross-issue interests, it would need to be a central element of some future WTO round. As such, its successful conclusion might be expected to take up to 10 years.

Summary proposal

It is naïve to think that a centralized information agency, charged both with creating new knowledge and disseminating it globally, is feasible. The essential problem is more one of coordination across specialized public agencies and private actors, along with the ability to gather, share and analyse data and information in a way to help improve country performance and to set the agenda for future global priorities. It also is important to encourage more coordination in setting standards in areas that to date have been in conflict, such as the TRIPS agreement and the Convention on Biological Diversity.

Expanding the World Bank's mission into this form of activity would be the most effective means of moving towards these goals. It would be efficient in that the Bank may not need much in the way of additional resources to gain competence in information coordination. It would also take advantage of economies of scope in the existing roles of the Bank. Finally, the World Bank has extensive experience in achieving

coherence in policy formation with the IMF and the WTO, suggesting that it could operate similarly in information sharing, an area in which it is already extremely active. In contrast, to extend the traditional competency of such specialized agencies as WIPO and the WTO would require major additional resources, while threatening to overwhelm the underlying functionality of those agencies.

There is scope for significantly extending the WTO agreements in ways that could strengthen the international information-sharing system without excessively departing from the agency's essential trade-policy function. One way would be to negotiate a treaty on access to basic science and technology. A second would be to work within the GATS framework to expand temporary visa allocations for permitting technical and managerial workers from middle- and low-income countries to work in laboratories, universities and enterprises in developed countries (Hoekman, Maskus and Saggi 2005). Again the advantage of the WTO approach lies in its ability to achieve cross-issue bargaining outcomes that could facilitate these ideas.

The one area in which a coordinated international public approach to developing new products arises is in medicines for diseases in poor countries. Here there is a role for the WHO to serve as an agency to gather foreign assistance pledges for this purpose, offer monetary payments for the development of new drugs and disseminate the medicines widely and cheaply.

Notes

1. This outcome is not necessarily true. In some areas involving extensive cumulative innovation, open-source development may be an effective substitute, as in software and biotechnology.
2. These questions are discussed at length in the paper by Maskus and Reichman (2005).
3. See Walsh, Arora and Cohen (2003) for a survey-based sceptical view of the proposition that these costs deter scientific research. Their data indicate that there were sometimes costs and delays associated with, for example, obtaining licences, conducting research offshore, running the risk of infringement or modifying research strategies.
4. The major exception is that least developed countries were granted until the year 2016 to enforce the rules regarding patents on essential medicines under terms of the Doha Declaration.

5. See, for example, Reichman (1997); ICTSD (2005); World Bank (2001). The discussion here is based on World Bank (2001).
6. Hoekman, Maskus and Saggi (2005) offer an extensive analysis.
7. Maskus and McDaniel (1999) found statistically that this approach was useful for diffusing new technologies into the Japanese economy.
8. In this regard Maskus and Reichman (2004) argue that by adopting such rigorous standards, developing countries could provide a competitive environment for the use and development of information, perhaps ultimately pressuring richer nations to moderate their own standards.
9. Reichman and Lewis (2005) offer an extensive model for how such "liability rules" would work and describe their advantages for development.
10. UPOV refers to a series of revisions of a treaty for the protection of plant varieties, which is known by its French acronym. The 1978 revision serves as a model for developing countries, but is not now available for accession. The 1991 version provides stronger protection for breeders and is open for membership.
11. For example, the US Digital Millennium Copyright Act considerably narrows the scope of fair use of copyrighted materials and sets out extensive criminal penalties for circumvention.
12. Barton (2005) discusses patent harmonization efforts in detail.
13. See New (2005).
14. Maskus (2002) discusses these possibilities and the sensibility of incorporating TRIPS into the WTO.
15. See Hoekman, Maskus and Saggi (2005).
16. World Bank President Wolfensohn set forth this goal in his 1996 annual meetings address.
17. See also Sabel and Reddy (2002) and Finger (2002) for arguments in favour of regulatory experimentation in other contexts.
18. See Hoekman, Maskus and Saggi (2005) for further thoughts.
19. Barton and Maskus (2005) set out the proposal and offer a detailed justification.
20. It should be noted that the proposal by Barton and Maskus (2005) has attracted favourable attention among developing country delegations at the WTO, while developed country delegations have adopted a "wait and see" approach so far.

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Capacities for Global Management of Intellectual Property: Mapping Out Global Initiatives and Opportunities for Improvement

Chapter 4

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The international intellectual property regime was established to promote investment in scientific and technological innovation and technology transfer, eventually contributing to the economic development of the countries participating in it. Its global application is seen as critically important to achieving the Millennium Development Goals (MDGs). But while it is effective in most developed countries, it is now generally accepted that it does not adequately serve the needs of developing countries (Barton 2006b). They often cannot benefit from the protection and incentives the system is meant to provide, and costs for implementation at the national level are considerable. Hence a global effort to improve the design and implementation of the intellectual property regime is of crucial importance.

Such an effort is in line with goal 8: "Build a global partnership for development" and target 12: "Develop further an open, rule-based, predictable, non-discriminatory trading and financial system. It includes a commitment to good governance, development and poverty reduction—both nationally and internationally."[1]

The potential for success is adversely affected by the asymmetries in capacity between developed and developing countries. Hence this chapter focuses on what is required for developing countries as well as for international organizations and institutions to address these asymmetries effectively. It reviews the information available to respond to four questions:

- *What types of capacities do developing countries need to enable them to participate in and benefit fully from the international intellectual property regime?*
- *What efforts are key international players undertaking to promote developing country participation?*
- *What is known about the adequacy and effectiveness of these efforts?*

- *What can be done to improve current capacity strategies?*

Global capacity initiatives to manage intellectual property are relatively recent and quite dispersed. This paper thus presents a preliminary overview, not exhaustive or conclusive answers to the four questions. Yet it includes several practical suggestions for improving capacity development to achieve effective participation by developing countries in designing, implementing and using the global intellectual property regime.

Global management of intellectual property is as much about ownership as it is about property (Engel 2006).

Our mapping of capacity development initiatives takes stock of the work of more than 30 multilateral and international institutions, bilateral donors and donor agencies, non-governmental organizations and research centres from both developed and developing countries. Most of the initiatives financed by bilateral donors support the implementation of article 67 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and concentrate on training and human resource development, legal and policy advice and support to implement or modernize intellectual property rights administrative offices and information services. The extent and coverage of these initiatives seem to reflect more the particular, short-term interests of donor countries and agencies and less those of developing countries. But intergovernmental institutions and particularly non-governmental organizations are gradually moving towards increased support for national research and development, policy analysis and innovation in developing countries, including developing negotiation strategies and skills. Of particular concern to UN agencies and some non-governmental ones is the "global knowledge commons", the term coined by Joseph Stiglitz for traditional knowledge, its legitimacy, protection, valorization and use for creating value under the global intellectual property regime.

Neither systematic assessments of developing country needs nor monitoring and evaluation of results and outcomes is high on the list of priorities of the key players in intellectual property capacity development. This, together with the rather dispersed nature of assistance, the apparent bias of some donors in providing support and the short-term time frames allowed, underlines the great need for improved governance and coordination on the part of national and international organizations.

The paper pulls together lessons and recommendations for improving intellectual property capacity development initiatives. The sources include the Commission on Intellectual Property Rights, the UNDP Capacity Development Forum, the Joint World Intellectual Property

Organization (WIPO)-WTO African Workshop on the TRIPS Agreement, with special reference to least developed countries and the International Centre for Trade and Sustainable Development (ICTSD)-United Nations Conference on Trade and Development (UNCTAD) Dialogue. In combination with the evident shift in focus from technical assistance towards more comprehensive capacity strategies in international trade policy, these sources provide a foundation for a significant jump forward in thinking and practice. A central lesson is that intellectual property capacity development initiatives need to go beyond simply supporting the national implementation and management of the international intellectual property regime in such activities as designing and implementing laws and regulations and improving the institutional infrastructure needed for compliance. Initiatives should also support developing countries in enhancing their independent capacities to design and implement negotiation strategies and to strengthen their research, development and innovation systems. The valorization of their indigenous and intellectual resources is also critical. These efforts should focus on enhancing the capacity of developing countries not only to apply the international intellectual property regime but also to actually draw concrete benefits from it. It is only then that developing countries will feel true commitment and ownership of intellectual property rights.

This chapter emphasizes the need to improve the scope, approach, coverage, level of funding and depth of current initiatives, as well as to increase their effectiveness and efficiency. Global efforts need to be more inclusive and long term, with the aim of improving developing countries' capacities to benefit from intellectual property treaties and to use intellectual property protection for their own knowledge and knowledge-intensive products. Reaching these goals requires strengthening global governance of the intellectual property regime and improving coordination of capacity development efforts. With these goals in mind, we present specific recommendations on six main issues:

- Redefine capacity development for global management of intellectual property to better incorporate lessons of experience.
- Promote the active participation of public and private stakeholders in developing countries in intellectual property debates and in designing, implementing and negotiating national intellectual property strategies.
- Encourage developing country governments to take an active role in creating an enabling institutional and business

environment, to strengthen national policy and research institutions, to promote adequate protection and use of indigenous knowledge resources and to stimulate innovation and creativity.

- Urge WIPO and the WTO to implement more inclusive and development-conscious intellectual property capacity development programmes and to include a broader constituency of policy-makers, scientists and civil society groups, particularly from developing countries, in the governance of their programmes.
- Mandate and adequately fund an intergovernmental global institution to lead and orchestrate long-term global efforts for intellectual property capacity development. It should facilitate national needs assessments as a basis for designing, coordinating and monitoring global efforts.
- Substantially increase donors' long-term financial commitment to and support for intellectual property capacity development in developing countries.

Global asymmetries require a comprehensive approach to intellectual property capacity

The international intellectual property (IP) regime was established with the aim of stimulating invention, increasing research and development, promoting technology transfer and foreign investment, and eventually contributing to the economic development of the countries applying it. As such, its global application is considered of critical importance for eliminating poverty and achieving the MDGs. However, while the system has been effective in most developed countries, it is now generally accepted that in its present form it does not adequately serve developing countries' needs[2]. In practice, most developing countries fail to benefit from the protection and incentives the system is meant to provide, whereas national implementation costs are considerable. Hence to improve the design and implementation of the global IP regime is of crucial importance and requires a truly inclusive, global effort.

Such an effort is in line with, in particular MDG 8: "Build a global partnership for development" and target 12: "Develop further an open, rule-based, predictable, non-discriminatory trading and finan-

cial system. It includes a commitment to good governance, development, and poverty reduction—both nationally and internationally."[3]

The potential for success of such an effort is adversely affected by the current asymmetries in capacity between developed and developing countries, regarding the preparation, negotiation and application of global arrangements on IP. Therefore this paper will focus on the capacity requirements on the part of developing countries and international organisations and institutions to address such asymmetries effectively. To do so it will review the existing literature and seek to answer the following questions:

- What types of capacities are needed in developing countries to enable them to participate in the design, implementation and use of the international IP regime effectively?
- What efforts are undertaken now by key international organizations and institutions to promote effective participation of developing countries on IP?
- What is known about the effectiveness of these efforts?
- How can capacity strategies to promote effective participation in the design, implementation and use of the international IP regime be improved?

Global capacity initiatives with respect to IP management are relatively recent and quite disperse. Therefore the purpose of this paper is to present a preliminary overview and analysis of the information available at the moment, rather than an exhaustive or conclusive answer to each of the above questions. This will allow us also to signal some of the gaps that currently exist. These, as we will see below, are considerable as capacity development for global management of IP has been focused mostly on technical assistance. The overview allows for a number of practical suggestions on capacity development for improving the participation of developing countries in the design, implementation and use of the global IP regime, including some on the need to improve our knowledge of the subject.

Developing countries have been required to fully implement the TRIPS Agreement only since 2000, and the least developed countries must comply with it by 2006. Consequently, strengthening the developing and least developed countries' capacities to effectively enforce the multilateral intellectual property rules and comply with the intellectual property regime is a recent item on donors' agendas. The WIPO, the main provider of intellectual property technical assistance, extended its

activities to developing countries only in the past 10–15 years. Most international organizations started intellectual property assistance programmes in the late 1990s, a few years after the TRIPS agreement took effect (in 1995). The most common approach is best summed up in article 67 of the TRIPS agreement on technical cooperation[4]:

> In order to facilitate the implementation of the Agreement, developed country Members shall provide, on request and on mutually agreed terms and conditions, technical and financial cooperation in favour of developing and least developed country Members. Such cooperation shall include assistance in the preparation of laws and regulations on the protection and enforcement of intellectual property rights as well as on the prevention of their abuse, and shall include support regarding the establishment or reinforcement of domestic offices and agencies relevant to these matters, including the training of personnel.

However developing countries are in a weak position to benefit from the protection of intellectual property rights (Barton 2006a; CIPR 2002; ICTSD-UNCTAD 2003). In 1999 India, Brazil and South Africa were the only developing countries among the 32 countries leading in patent applications. They also invest the most in research and development among the middle- and low-income countries. Nevertheless they share less than 0.3% of patents registered (OECD 2003; Juma and others 2001). Reasons for this asymmetry are many.

Establishing and operating a national intellectual property system requires not only effective legislation and a well functioning administrative and enforcement system but also private sector involvement, investments in research and development and numerous experts willing and able to follow-up, advise and help the government engage in international negotiations and decision-making. Educational systems, intermediary institutions and dedicated media need to provide adequate support. Barton (2006a, p. 13) points to the huge capacity gap that exists:

> OECD countries spend more annually on research and development than the value of total economic output of 61 of the world's lowest income countries. Again compared with low-income countries, OECD countries have 12 times the per capita number of scientists and engineers working in research and development and publish 25 times more scientific journal articles per capita. In the OECD the

ratio of patents filed by non-residents to those filed by residents is 3.3 to one, while in low-income countries it is 690 to one.

Acquiring a patent is often a long, time-consuming, expensive process requiring expert legal capacities not only for the acquisition but also for the defence of the patent. As a result the protection of intellectual property rights is seen as too costly in countries where priorities include eradicating poverty or illiteracy; delivering basic services, infrastructure and health; and providing food security.

Moreover, developing countries are often adversely affected by the global intellectual property regime. Tightening the rules for protecting intellectual property has led to increased privatization and commercialization of knowledge, often with dramatic consequences for the poor. Patents—especially in health and agriculture—frequently render products unaffordable to people or governments in developing countries, depriving poor people of access to products and technology vital to their well-being and development. Unfortunately the system does not provide incentives for developed countries to invest in research for small developing markets—usually too imperfect and too small to be profitable for foreign private firms—although such investments are crucial to help developing economies grow and become globally competitive in the medium to long term (Bulard 2000; Juma and others 2001). Nor does the multilateral system provide incentives for private companies to allocate funding or resources for research specific to developing countries' needs (Barton 2006a).[5]

Poor countries can seldom take advantage of the intellectual property regime to increase protection of their traditional knowledge and innovations. In developing countries and particularly among indigenous communities, knowledge and resources are for the most part tacit, embedded in traditional cultural or social practices and rarely the property of one individual. They are often transmitted from generation to generation and shared throughout the community, and the current regime does not provide for a community's common resources to be patentable as such. In short, the current intellectual property regime is tailored to meet the needs of countries with an efficient market economy, with effective research and development institutions and the capacity to create and access new knowledge and to exploit it commercially. As specified by WIPO (2004d, p. 164), it is designed to "serve the needs of traders, manufacturers, industrialists, researchers, businessmen and consumers".

Finally, obvious asymmetries emerge as a result of power differentials (political and financial) between corporations and governments

on the one hand and local communities and indigenous people on the other hand. Indigenous communities—without always being aware of it—face the danger of theft or misappropriation of their knowledge on a daily basis, but their legal means to protect it are limited (Posey and Dutfiel 1996). Even when they achieve such protection they rarely have the technical and financial means to follow up and ensure its enforcement. As pointed out by the UNDP (2001, p. 7): "A single set of minimum rules may seem to create a level playing field, since one set of rules applies to all. But as currently practised, the game is not fair because the players are of such unequal strength, economically and institutionally."

Clearly, addressing general asymmetry is only part of the task. The complexities involved in designing, negotiating, implementing and benefiting from international intellectual property conventions require tailor-made solutions. Not every developing country is affected the same way. Impacts depend on the country's level of social, economic and political development and the efficiency of its research and intermediary institutions, its private sector, its legislation and its networks and infrastructure.[6] A one-size-fits-all approach to capacity building obviously will not work. To meet the challenges, deep investments in public and private institutions, the business environment and knowledge institutions are needed in developing countries.

Main intellectual property capacity development initiatives at the global and regional level

Providers and donors of technical assistance can be distinguished into three main categories (see table 4.1):

- International institutions (multilateral and UN agencies, intergovernmental and regional organizations)
- Bilateral donors and donor agencies (development agencies and patent offices in developed countries)
- Non-governmental organizations and research centres in developed and developing countries (including civil society groups, business and lawyer associations and philanthropic foundations)

The technical assistance provided by international organizations takes place essentially at four levels: training and human resource development, legal and policy advice, support to implement and modern-

Table 4.1 **Main intellectual property technical assistance providers and donors**

International institutions	Bilateral donors and donors agencies	Non-governmental organizations and research centres
WIPO/International Union for the Protection of New Varieties of Plants	United States (Agency for International Development, Patent and Trademark Office)	International Centre for Trade and Sustainable Development
European Patent Office	The European Union (European Commission and its member states, such as the UK Department for International Development or Sida)	Quaker United Nations Office
UN agencies (UNCTAD, UNDP, UNESCO)	Canada (International Development Agency)	International Development Research Centre
World Bank	Switzerland (Development Cooperation Agency)	Oxfam
World Trade Organization	Australia	Médecins sans Frontières
Food and Agriculture Organization	Japan	Center for International Environmental Law
African Intellectual Property Organization/African Regional Industrial Property Organization	Norway	African Agricultural Technology Foundation
South Centre		
OECD		

ize intellectual property rights administration offices and information services on intellectual property matters. Bilateral donors and non-governmental organizations get involved, to a lesser extent, in supplying research and analysis on intellectual property issues relevant to developing countries, building developing countries' negotiation abilities and promoting innovation and creativity.

International institutions and regional organizations

The World Intellectual Property Organization

WIPO is mandated to organize the negotiation and administration of intellectual property treaties. Its objective is to promote the effective protection and use of intellectual property. It is responsible for maintaining, monitoring and further developing respect for intellectual property throughout the world, as well as helping countries develop, use and protect their national creativity, innovation and intellectual assets. A specific task is to "assist developing countries in their capacity building for greater access to, and use of, the intellectual property system" (WIPO 2004b, para 7). It provides assistance to developing countries through its Cooperation for Development programme, targeted towards helping developing countries build and update their legislative and administrative structures and strengthen their human capacities to deal with intellectual property rights.

WIPO's Cooperation for Development programme. Cooperation for Development is a comprehensive programme designed to develop and strengthen developing countries' capacities to deal with and make optimal use of the intellectual property system for economic, social and cultural development. It is carried out through WIPO's International Bureau, Permanent Committee on Cooperation for Development Related to Intellectual Property and four regional offices (Africa, Arab States, Asia and the Pacific and Latin America and the Caribbean) in collaboration with governments, institutions and individuals. The major objectives are to assist developing countries in:

- Establishing modern and well functioning intellectual property systems by developing efficient national legislative and administrative infrastructures and policies.
- Developing and strengthening their human resources.
- Promoting innovation and creativity.
- Promoting adequate intellectual property protection in support of their traditional knowledge and folklore.
- Developing and facilitating access to technological information.
- Promoting awareness in local enterprises and educational institutions of the value of the intellectual property system.

For 2004–05, WIPO's expenditures on development cooperation were budgeted at approximately CHF 95 million (Swiss francs), a 0.3% increase since 2002–03 (WIPO 2003c). This represents 14.8% of WIPO's total programme budget. The figures should nevertheless be considered with caution. About 54% of these expenditures are staff-related expenses rather than programme costs, although the staff is directly involved in delivering and managing some technical cooperation activities. These figures do not include expenditures on WIPONet, expected to amount to CHF 97 million between 2000 and 2005 (Pengelly 2004). Although WIPO does not provide public data on the geographical distribution of its technical assistance, it appears that most goes to Latin America and Asia-Pacific (see table 4.2; Leesti and Pengelly 2002).

As acknowledged in the programme description, "there is no one-size-fits-all model for intellectual property infrastructure and systems within developing countries and least developed countries."[7] WIPO's initiatives try to respond to diverse needs and challenges and to build networks among many stakeholders—from government officials to entrepreneurs, inventors and innovators, researchers, civil society actors, students, artists and traditional knowledge holders (see table 4.3; WIPO 2003a).

Table 4.2 **WIPO's expenditures for intellectual property technical assistance programmes, 1996–2003**

(CHF millions)

1996–97	1998–99	2000–01	2002–03	Total
45	58	71	92	266

Source: WIPO Programme and budget documents (www.wipo.int/about-wipo/en/budget.html); Leesti and Pengelly (2002).

WIPO runs a well developed system of results-based budgeting for its intellectual property technical assistance programmes and has developed a detailed set of performance indicators. It is the only donor organization undertaking such an elaborate programme evaluation. In 2003 it published a programme performance report for its 2002 activities, detailing expected outcomes and actual results of its initiatives (WIPO 2003b). But the report does not quantify nor assess the effect of its activities on human and institutional development, providing information only on activities delivered in regions, not specific countries.

WIPO's mandate does not state explicitly that the organization should promote development and that the policies it endorses should be development oriented. WIPO's view—increasingly called into question—is that intellectual property is a valuable asset and tool for economic, social and cultural development. As a specialized UN agency WIPO is committed to implement the UN MDGs. While praising its efforts in terms of technical assistance and technical cooperation, more and more non-governmental organizations and experts working on intellectual property and development are demanding that WIPO acknowledge the high costs to developing countries that global intellectual property protection generally entails. They also request more flexibility towards the degree of protection it requires developing countries to apply, allowing them to protect their intellectual property in line with the level of socio-economic development of their economy (Moon 2002; CIPR 2002). In October 2004, after difficult negotiations and pressure from a large coalition of developing countries and non-governmental organizations, the WIPO General Assembly eventually endorsed the proposal by Brazil and Argentina to establish a development agenda within WIPO (WIPO 2004b; Brazil and Argentina 2004). The assembly decided to add it to its 2005 agenda and to produce a report by the end of July 2005 on the basis of the proposals made by various countries. How this move will be translated in practice is not clear, but given the involvement of the developing countries, this might be a first step in the move from mere technical assistance towards intellectual property capacity development.

Table 4.3 **WIPO's main activities for its Cooperation for Development programme**

Information, legislative and technical assistance on the patent and intellectual property system	WIPONet Global Information Network, WIPO Patent Information Service, Least Developed Countries Initiative, Collection of Laws for Electronic Access WIPO provides special assistance in drafting and implementing intellectual property legislation. At the request of governments, it can help design national policies and prepare or amend legislation to deal with any aspect of industrial property, copyright or related rights. This assistance can be legislative advice, comments or explanations, and evaluations or studies of existing laws or laws in development.
Human resource development and training	WIPO Worldwide Academy WIPO also organizes seminars, workshops and specialized courses and cooperates with universities to provide teaching and research on intellectual property law.
Institutional development and automation	WIPONet WIPO provides technical, advisory and institutional assistance to help developing countries build their national and regional intellectual property infrastructures and systems (software and other communication equipment). For instance, through WIPONet, it has equipped 154 intellectual property offices with Internet connectivity and basic equipment.
Promotion and awareness-raising activities	WIPO provides special awareness and support to creators, innovators, research and development institutes and universities, and small and medium enterprises to help them increase their understanding of intellectual property matters and enhance their use of and benefit from intellectual property systems (for example, promotion campaigns targeting chief executive officers; seminars, study groups, advisory missions and training programmes for enterprises; production of guidelines and CD-ROMs).
Promotion of creativity and innovation	WIPO helps governments devise ways to promote indigenous creativity, innovation and inventiveness. It has set up databases and inventories of traditional and indigenous knowledge.

WIPO's Intergovernmental Committee on Genetic Resources, Traditional Knowledge and Folklore. On traditional knowledge, genetic resources and traditional cultural expressions (folklore), WIPO collaborates with other international organizations including the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Food and Agriculture Organization of the United Nations (FAO). In late 2000 it set up the Intergovernmental Committee on Genetic Resources, Traditional Knowledge and Folklore, a forum for international policy debates concerning the interplay between those areas and intellectual property protection. The committee's traditional knowledge activities consist of undertaking and publishing technical analyses, case studies, questionnaires and surveys; providing inventories and databases; and coordinating regional dialogues, information meetings, round tables or working groups.

In its *Annual Report 2003* WIPO refers to its capacity building and policy information activities with traditional knowledge holders, national bodies and regional organizations as consisting of "publication of articles and studies, as well as support for numerous training programmes and seminars conducted by non-governmental organizations, partner UN agencies, the WIPO Academy and other educational and training institutions" (p. 17). The only international institution working to build the capacities of indigenous peoples, WIPO activities appear very limited with respect to the needs faced by this population.

Moreover, at the Bellagio Dialogue organized by the UNCTAD and ICTSD, clearer objectives, a coherent rationale and adequate links to customary law and cultural diversity were strongly recommended to ensure greater effect of activities in those areas (ICTSD-UNCTAD 2003). WIPO's Intergovernmental Committee should take up this responsibility.

The World Trade Organization

The TRIPS Council is the body responsible for administering the TRIPS agreement and ensuring members' compliance with their obligations. For technical assistance on intellectual property, the WTO Secretariat is the performing body, as part of its broader mandate to provide trade-related technical assistance to its members. The purpose of the WTO's technical assistance is "to assist developing and least developed countries and low-income countries in transition to adjust to WTO rules and disciplines, implement obligations and exercise the rights of membership, including drawing on the benefits of an open, rules-based multilateral trading system." Its technical assistance should aim at small, vulnerable and transition economies, as well as at members and observers without representation in Geneva (WTO 2001b, para 38). TRIPS-related technical assistance aims to help developing countries use the multilateral trading system. It consists essentially of institution building and staff training through seminars, workshops, technical missions (legislative assistance), briefing sessions (updates to Geneva-based delegations and visiting officials), electronic information provision and training courses. The WTO's current budget for technical cooperation is CHF 1.36 million, for training it is CFH 4.29 million (WTO 2005). The actual funds dedicated to intellectual property or TRIPS technical assistance are not specified in any WTO public documents.

WIPO-WTO Cooperation Agreement. In the framework of the 1996 Cooperation Agreement to streamline intellectual property positions and activities, the WIPO International Bureau and the WTO Secretariat have agreed to provide legal and technical assistance and cooperation on the same terms to their organizations' developing country members, ensuring that their related activities are mutually supportive and their usefulness maximized. The agreement does not detail what the assistance and cooperation encompass in terms of activities.[8]

The two organizations subsequently launched two joint initiatives to help developing countries comply with their TRIPS commitments and obligations. The first initiative was launched in 1998 for developing countries committed to comply with the TRIPS agreement in 2000, and the second in 2001 for the least developed countries, due to comply with TRIPS in 2006.

For both initiatives, technical assistance has consisted of preparing legislation, providing training and institution building, and modernizing and enforcing intellectual property systems. For least developed countries the initiative was divided in two phases. In the first phase in 2002 two regional workshops (one for Sub-Saharan Africa and Haiti, and one for Asia and the Pacific) provided a forum for WTO, WIPO and senior country officials to discuss the basic concepts, principles, obligations and challenges of TRIPS. The second phase provided assistance to individual countries by designing and implementing specific action plans. There is no budget or funding for these initiatives from either of the two organizations. We can assume that such funding is part of their general budget for TRIPS-related technical assistance.

The European Patent Office

In addition to granting and managing patent applications, part of the European Patent Office's (EPO) mandate is to deliver technical assistance, promote technology transfer and foster international cooperation and harmonization in patent practices and procedures. The Directorate for International Cooperation within EPO is entrusted with these tasks. The EPO committed almost $19 million between 1996 and 2001 to intellectual property technical assistance programmes. Its funds were relatively evenly distributed among the six regions it works in and the information technology unit (see table 4.4; Karachalios 2002).

The EPO works with European and international organizations (WIPO, the European Commission, the Office for Harmonization in the Internal Market, the Benelux Trademark Office), EPO member

Table 4.4 **EPO's budgetary resources for intellectual property technical assistance, 1996–2001**

Year	Budget per year (€)	Region	Budget for each region, 1996–2001 (€)
1996	2,600,000	Africa and the Middle East	3,100,000
1997	2,875,000	China	2,650,000
1998	3,050,000	Commonwealth of Independent States	2,650,000
1999	3,050,000	Eastern Europe	3,700,000
2000	3,575,000	Latin America	2,200,000
2001	3,650,000	South-East Asia	2,050,000
Total	18,800,000	Total	18,800,000[a]

a. Includes €2,500,000 for the information technology unit (automation projects).

Source: Karachalios (2002).

states, national intellectual property offices, specialized institutes and research centres and universities. It draws its expertise from specialists in research, examination, documentation, patent law and information technology. According to the support required by its partner countries and on the basis of a needs assessment by EPO project partners with appropriate government authorities, it carries out national and regional vertical or horizontal projects. These projects include providing guidance, advice and structural and technical support in implementing and organizing intellectual property structures (sharing its information technology products[9]), as well as providing information, documentation and material (books, software, hardware), staff training (through the EPO International Academy, with a focus on training the trainers) and patent awareness building in national patent offices throughout the world. The EPO offers its support to national intellectual property authorities and special assistance to stakeholders in the legal, industry, trade, culture, education and other sectors involving intellectual property (see table 4.5).

For instance the EPO and its partners at the Project for Africa and Middle East are working on strategies and new tools to stimulate innovation, such as new documentation and information technology tools and development and acquisition of new personal skills

Table 4.5 **The EPO's capacity building initiatives in its cooperation programmes, by region**

Central and Eastern Europe	Most central and eastern European countries are now members of the EPO. Assistance programmes include: • Training and seminars on public relations and promotion of awareness of intellectual property where appropriate—aimed not only at staff in intellectual property offices but also at patent attorneys, lawyers, information and documentation specialists, scientific and research institutes, universities, trade and industry, small and medium enterprises, individual inventors. • Building national intellectual property office infrastructure. • Developing information technology systems.
Turkey	Cooperation in Turkey has focused on: • Building a documentation centre at the University of Ankara for the use of specialised courts for the enforcement of intellectual property rights • Working to raise awareness of intellectual property in Turkey and to introduce key legal concepts and the most important active institutions. • Hosting a symposium, involving representatives of European and Turkish institutions, on the status of intellectual property and its enforceability there.
Commonwealth of Independent States and Mongolia	The EPO's technical assistance programmes with national intellectual property offices and the Eurasian Patent Office are: • Building national intellectual property systems. • Training staff, including trainers, in patent administration and data processing. • Developing patent information systems. • Promoting awareness of intellectual property rights in the research and legal community.
Asia	The EPO has trained large numbers of staff from the state intellectual property office in China, both in Asia and in Europe. The EPO has also provided the state intellectual property office in China with patent databases and administration software, permitting online searches for the state of the art in different fields of technology. In addition to the programme with China, the EPO is also engaged in providing technical assistance to Brunei, Cambodia, India, Indonesia, Laos, Malaysia, the Philippines, the Republic of Korea, Singapore, Thailand and Viet Nam. EPO-financed technical assistance with these countries is focused on: • Training patent examiners. • Providing technical support for patent examination. • Promoting regional cooperation in intellectual property administration.
Latin America	Primary recipients of technical assistance are Argentina, Brazil, Chile and Mexico. Activities with countries in Central America and the Andean Community began only recently, in collaboration with WIPO. EPO technical assistance is focused on: • Training (seminars at the EPO International Academy and in the region). • Providing automation support (assistance in electronic publishing, database development and software for patent administration, most notably SOPRANO-CS).

continues

and capacities (for engineers, documentation experts and innovation and business consultants). They also organize large events (regional conferences, forums, seminars) to promote the exchange of experiences.

Africa and the Middle East

The EPO's most active intellectual property technical assistance programmes in Sub-Saharan Africa are with South Africa, OAPI and ARIPO. In the Middle East framework agreements with the EPO are in place with Algeria, Egypt, Morocco, Tunisia and the patent office of the Gulf Cooperation Council. Links have also been established with Jordan, Lebanon and Syria. Technical assistance focuses on:

- Developing and implementing integrated plans, based on local requirements, for building small and medium intellectual property authorities.
- Promoting knowledge transfer to enable project partners to build on existing know-how and pass it on within the region, thus promoting interregional cooperation.
- Developing instruments to access, use and evaluate patent information to promote technologies of particular value to the region—for example, tools to search for unpatented technologies.
- Adapting EPO training programmes as required, such as setting up local training centres.

Source: European Patent Office
http://int-coop.european-patent-office.org;
http://annual-report.european-patent-office.org/2003/int_affairs

Regional African intellectual property organizations

A few intellectual property organizations exist at the regional level. In Africa two have effectively strengthened the intellectual property infrastructure in their member states since the 1970s, one for the Francophone countries, known as the Organisation Africaine de la Propriété Intellectuelle (OAPI) or African Intellectual Property Organization, and the other for the Anglophone countries, the African Regional Industrial Property Organization (ARIPO).

The OAPI was created in 1977 as a result of the revision of the 1962 Libreville agreement by the Bangui agreement. An intergovernmental body, it serves as a national rights-protection department for each of its 16 member states. It is in charge of delivering uniform intellectual property rights protection and implementing and applying common administrative procedures. Its responsibilities also include providing intellectual property training; centralizing, coordinating and disseminating information and documentation about patents, trademarks and registered designs; and contributing to the economic and technological development of its member states. It applies uniform patent legislation for each member state through the Bangui agreement. An OAPI patent is valid in all the member countries, thus reducing costly and time-consuming administrative and legal procedures.

ARIPO was established in 1976 by the Lusaka agreement, responding to special requests by African governments in the early 1970s to the United Nations Economic Commission for Africa and WIPO to set up a regional organization to pool member resources

and promote harmonization and cooperation on industrial property matters. In addition to those roles, ARIPO provides training schemes for staff in the administration of intellectual property law; organizes conferences, seminars and meetings; encourages the exchange of experiences and ideas, research and studies on intellectual property matters; and seeks to promote and develop a common view and approach on intellectual property issues.

The World Bank

In his 1996 annual meetings address, James Wolfensohn, president of the World Bank, declared that development knowledge was a global public good and decided to establish the knowledge bank. Since then, sharing knowledge to help the development community work more effectively to reduce global poverty has been a key operational activity at the World Bank. The knowledge-sharing programme, which embraces many diverse initiatives, is implemented through ongoing collaboration with the World Bank Institute and the World Bank's regional and network departments. It takes place at three levels: corporate, regional and country, and global. Most of the initiatives are informative and related to information and communications technology and consist essentially of aggregating, storing and sharing information. They can be divided into three categories: global network initiatives, global and national portal-based knowledge services, and information databases, both on indigenous knowledge and best practices and on advisory services.

Since 2002 the World Bank Institute has strengthened its capacity enhancement strategy for development. More of its programmes are designed for long-term institutional capacity building, seeking to meet countries' needs by "bringing best practice pedagogy and technology to all our knowledge products, services and activities" (World Bank Institute 2003, p. 32). It provides capacity building support services and country programme briefs, thematic learning programmes (courses, seminars, distance learning), learning products, policy advisory and knowledge services, diagnostic tools and evaluation, and certification programmes. In 2003 it developed new tools to promote its capacity enhancement programmes—capacity enhancement needs assessments, country capacity enhancement strategies, country programme briefs—integrated with the Bank's country assistance strategies, together with various governance and knowledge assessment indicators at the country level, and pilot programmes.

World Bank technical assistance in trade—targeted at researchers and trainers, policy advisers and negotiators, civil society and the private sector—consists of helping developing countries develop sound national trade policies, participate effectively in the WTO and increase their understanding of the benefits and costs of increased liberalization. The organization's current programmes focus on:

- Building client countries' research capacity.
- Building deeper understanding of trade policy choices.
- Fostering and facilitating debate.

The World Bank does not deal with intellectual property as such, so strengthening the capacities of developing countries related to intellectual property is not one of its working areas. Its capacity building activities dealing with intellectual property are integrated in larger projects. In the 1990s, for instance, it financed intellectual property capacity building programmes (in Indonesia, Brazil, Mexico) as part of larger programmes promoting research and development and building scientific, industrial and technological systems. Although too limited in number, these programmes can "provide a very different and value-added approach from those supported by most other intellectual property technical assistance donors and may enable better integration of intellectual property reforms and related capacity building within broader national development strategies of developing countries" (Pengelly 2004, p. 11).

In 1999 the World Bank launched a three-year research and capacity building project to help developing countries participate more effectively in the 2000 round of WTO negotiations. The project was carried out in collaboration with the WTO and various developing country research networks and think tanks, and it received support from a variety of donors (the United Kingdom, Italy, the Netherlands and the Société Générale de Surveillance). It was extended for a second phase in 2003 with a focus on building analytical research capacity in developing countries. Research was carried out on the effects, costs and benefits deriving from the implementation of TRIPS and the options available to developing countries (Hoekman and Martin 1999). It is difficult to find data on the World Bank's expenditures towards intellectual property capacity building, but its lending for trade capacity building has doubled from $132 million in 1998–2000 to $267 million in 2001–03 (OECD 2003).

UNCTAD's work on intellectual property consists essentially of the ICTSD-UNCTAD Capacity Building Project on IPRs and Sustainable Development set up in 2002. Financed by the UK Department for International Development (DFID), the project is hosted online at www.iprsonline.org. It is designed to improve understanding of the development and implications of the TRIPS agreement and to strengthen the analytical and negotiating capacities of developing countries. Through consultations, exchanges of views and information between policymakers, trade negotiators, experts, non-governmental organizations, international organizations and institutions from both developed and developing countries, UNCTAD and the ICTSD are producing four main series of documents: policy discussion papers, a resource book on TRIPS and development, research tools—mainly an inventory and a literature survey of material on intellectual property rights and sustainable development—and case studies selected at the suggestion of developing countries and negotiators.

In 2003 the UNCTAD-ICTSD Capacity Building Project on intellectual property rights launched the Bellagio Dialogues. These dialogues involve a diverse group of specialists, government experts and members of international and non-governmental organizations who meet in their personal capacity to assess current international trends on intellectual property and development. They aim to identify concrete recommendations that could help formulating development-oriented intellectual property policies. The second dialogue concentrated on advancing the reform agenda on intellectual property and development. Participants reaffirmed the need to ensure that developing countries are not "forced to adopt standards of protection incommensurate with their development needs and priorities" and that intellectual property technical assistance is delivered in response to countries' stage of national development (see box 4.1) (ICTSD-UNCTAD 2003, para 3).

Since 2000 UNCTAD has addressed traditional knowledge issues as part of its work on trade, environment and development. It has chosen to assist countries in exchanging national experiences on policies and measures to protect technical knowledge and in identifying policies to harness technical knowledge for trade and development. As a follow-up to an expert meeting it organized in October 2000, UNCTAD recently published *Protecting and Promoting Traditional Knowledge: Systems, National*

Experiences and International Dimensions, which addresses a vast array of questions in relation to traditional knowledge and development.[10] Technical knowledge is also a major topic in the framework of the ICTSD-UNCTAD Capacity Building Project.

The United Nations Educational, Scientific and Cultural Organization

UNESCO contributes to ensuring the adequate protection and promotion of global knowledge and cultural diversity. The organization intervenes to protect, safeguard and promote indigenous tangible and intangible knowledge in all its forms and carries out diverse activities—information, training and research, public awareness campaigns, assistance in legal and technical matters—designed to help people and countries understand and use the intellectual property rules (par-

Box 4.1 Second Bellagio dialogue—meeting report: technical assistance in intellectual property policy and development

Participants acknowledged that international technical assistance should be:

- Targeted and neutral.
- Demand driven.
- Based in the broad intellectual property knowledge community.
- Responsive to development concerns.
- Professionally responsible.
- Subject to evaluation.

Strategies for change included:

- Evaluating the effect of current technical assistance on development policies.
- Defining channels for reforming assistance.
- Calling for increased donor coordination.
- Integrating TRIPS-related technical assistance into the UN Integrated Framework and other broader technical assistance initiatives.
- Creating a network of assistance providers.

Policy-relevant research gaps in technical assistance included the need for:

- Better understanding of the use of flexibilities in the international intellectual property regime and particularly the TRIPS agreement.
- An analysis of model intellectual property laws used in technical assistance and their relationship to flexibilities (patentability exceptions, the Bolar exception and use of parallel imports).
- Devising alternative curricula and exploring different sources.
- Devising methodologies for evaluating assistance programmes in intellectual property.

Source: ICTSD-UNCTAD (2003).

ticularly copyrights) that relate to arts, culture, folklore and heritage. Through building capacity and sharing knowledge it also enhances the links between culture and development, helping developing countries define or update their national and local cultural policies. Last but not least, it is a leading defender of the global knowledge commons on the international scene and since its foundation has been an advocate for indigenous communities, submitting declarations, recommendations or conventions for adoption by its member states (for instance, the Convention for the Safeguarding of the Intangible Heritage in 2003, the Universal Declaration on Cultural Diversity in 2001, the Multilateral Convention for the Avoidance of Double Taxation of Copyright Royalties in 1979 and the Recommendation for the Protection of Movable Cultural Property).[11] The budgets for programmes and related activities are not available to the public.

The United Nations Development Programme

Building on the success of its Capacity 21 programme (see box 4.2), the UNDP launched its Capacity 2015 initiative in 2003 after the World Summit on Sustainable Development. Capacity 2015 aims to build national and especially local capacity in developing countries to help them meet their sustainable development goals and take advantage of the opportunities of globalization (see box 4.3). The initiative is coordinated by a small UNDP unit, functioning as both secretariat and technical support. The UNDP allocated $5 billion for the preparatory phase of the initiative; other partners are expected to join in the funding. Countries in which the initiative operates own and manage the project and contribute according to their ability.

The Capacity 2015 platform operates in all developing and transition countries, at different levels (regional, national, local), depending on the country's economic, political and administrative structures. UNDP staff seeks to develop local and national capacities at the institutional, individual and societal levels. Although it is not directly linked to intellectual property, the organization seeks to ensure coordination and complementarity between development initiatives and to foster mutual support and learning among partners working on capacity building, hence contributing to extending its own knowledge and learning network.

The initiative is implemented through six regional strategies (Africa, Arab States, Asia, Latin America, Central and Eastern Europe and

Box 4.2 Good practices identified from Capacity 21

Capacity 21 was the UNDP's instrument for implementing Agenda 21, the global sustainable development plan of action agreed at the 1992 Earth Summit. The programme was established to build the capacities of local institutions to integrate economic, social and environmental issues into development processes at the national, provincial and local levels. The programme generated very positive results, and several good practices were identified:

- Providing a demand-driven response to country and local needs that focuses on the priority issues of each country and region.
- Leveraging resources through strategic institutional and financial frameworks.
- Encouraging the convergence of political will, governance structures and stakeholder interest for sustainable development.
- Promoting local–local dialogues.
- Developing local–national links for sustainable development.
- Making programmes implementation flexible, to be more responsive to the needs and demands of stakeholders at all levels.
- Building partnerships and transferring responsibilities of implementation to various independent bodies.
- Ensuring a high level of ownership by countries relative to other donor projects.
- Using participatory learning and training of trainers.
- Translating the concept of sustainable development into concrete operational action.

Source: UNDP Capacity 2105 Information Kit
http://capacity.undp.org/indexAction.cfm?module=Library&action=GetFile&DocumentID=5048

Commonwealth of Independent States and Small Island Developing States). Capacity 2015 for Africa focuses on four areas: promotion of local governance, development of human resources through education for sustainable agriculture and natural resource management, enabling of strategic policy frameworks for sustainable development at local, national and regional levels, and knowledge networking and management. This fourth programme aims to develop information support and training systems and strengthen dialogue among developing countries to further develop and enhance local capacities and ensure demand-driven capacity development.

For Asia Capacity 2015 focuses on four similar aspects, taking into account the regions relatively more advanced economic and social development. The four areas are strengthening local governance, enhancing national and local frameworks for sustainable development and policy coordination, supporting subregions and other clusters of countries with shared needs and promoting information sharing, knowledge network-

Box 4.3 Building community capacity to cope with globalization

The long-term goal of Capacity 2015 is to increase annual average growth by 5% and economic output by 50% of small and medium enterprises, increase their contribution to poverty reduction by 50% and the improve the quality of the environment and natural resources base of the specific localities where they are situated by 2015. It has five immediate objectives:

- Increase the capacity of small and medium enterprises to avail themselves of opportunities offered by globalization, particularly in overcoming difficulties pertaining to markets, technology, human resource development, financing and meeting international environmental standards.
- Increase the capacity of local governments to provide the proper policy environment and the basic services and infrastructure for the optimal growth and functioning of small and medium enterprises in their localities.
- Increase the capacities of both the small and medium enterprises and the local governments to manage the risks of globalization—particularly inequality—and to implement practices to meet the country's commitments under the multilateral environmental agreements at the local level.
- Increase the synergy and partnership between the private sector, through the small and medium enterprises, and the local governments and other key stakeholders by strengthening local multi-stakeholder decision-making mechanisms.
- Establish mechanisms to capture the local experience of small and medium enterprises with the effects of global trade and other multilateral agreements, including small and medium enterprises, for input into the national and global negotiation processes.

Source: UNDP Capacity 2105 Information Kit
http://capacity.undp.org/indexAction.cfm?module=Library&action=GetFile&DocumentID=5048

ing and learning. More detailed interventions have been worked out for this last initiative, such as bottom-up learning and advocacy based on best practices, low-cost e-learning networks and education opportunities, participatory monitoring and evaluation of Capacity 2015 activities and incorporating MDG outcomes into the overall learning strategy.

Bilateral donors and donor agencies

Under article 67 of the TRIPS agreement on technical cooperation, developed countries provide technical and financial assistance to countries that request it. The assistance is provided either bilaterally (through national development cooperation agencies or intellectual property institutions) or multilaterally (through contributions to UN agencies and other international organizations, including the European Commission). The main providers of intellectual property technical assistance are the United States, the European Union, Canada, Switzerland, Norway, Japan and Australia (DDA Trade Capacity Building Database).[12] An overview of some of these bilateral donors follows.

Table 4.6 **USAID expenditure on technical assistance related to the TRIPS agreement, 1999–2003 (US$)**

1999	2000	2001	2002	2003	Total
770,632	3,020,831	3,558,952	6,215,359	7,027,824	20,593,598

The US Agency for International Development

USAID, whose expenditures on intellectual property technical assistance have increased tenfold between 1999 and 2003 to reach US$20.6 million, has set up a trade capacity building database, providing comprehensive information on intellectual property technical assistance (USAID Trade Capacity Building Database).[13] Detailed information on expenditures for 1999–2003 is provided by country and by region (see tables 4.6 and 4.7). Almost 16% of its total expenditures were committed to programmes in Eastern and Central Europe and about 7% (approximately $1.51 million) was allocated to programmes in Sub-Saharan Africa.[14]

The European Commission

The only data available on the European Commission's intellectual property technical assistance concern the funds being implemented by the EPO on its behalf. Those funds amount to about €30.44 million for 1990–2005, mainly allocated to Asia and Central and Eastern Europe (see table 4.8).

IP Australia

IP Australia is an agency operating for the Australian Department of Industry, Tourism and Resources. Its technical assistance programmes are usually funded by WIPO and targeted to Asia-Pacific countries in cooperation with and support of WIPO's technical assistance programmes and on the basis of WIPO's assessments of countries needs. For 2002–03 IP Australia allocated about AUS$671,000 to intellectual property technical assistance (see table 4.9). It uses feedback from recipient countries to evaluate the effectiveness of its programmes, while WIPO-sponsored projects are monitored by WIPO itself.

Table 4.7 **Examples of USAID intellectual property technical assistance projects, 2002**

Project	Country or region	Funding or source	Description
More open trade and investment policies	Central America	$1,307,972 USAID	Carry out activities to increase public support for open trade and investment policies, increase Central American compliance with the second Free Trade Agreement of the Americas business facilitation measures and with WTO recommendations on customs valuation, strengthen national intellectual property rights institutions and raise public awareness of intellectual property rights issues through effective dissemination of information.
Trade Capacity Building Project	Algeria	$129,450 USAID	Train judges in the civil administrative and criminal courts, as well as rights holders on intellectual property cases. Also train Ministry of Justice officials and the Algerian Judicial Training Centre. Draft a "Judge's Bench Reference Manual" on intellectual property. Consult with officials, rights holders and universities on technology transfer and licensing issues. Consult with Algerian judges on the TRIPS agreement. Host a workshop on "Protecting and Enforcing Intellectual Property Rights for Authors, Artists and Composers".
Intellectual property crimes training	Philippines	$60,000 US Department of State	Provide training to enable effective intellectual property rights crime enforcement.
Technical assistance for intellectual property rights enforcement	Costa Rica	$40,952 US Department of State	Develop a customs training programme for Costa Rican law enforcement and trade communities to encourage compliance and formulate policy for intellectual property rights enforcement.
Intellectual property rights	South Africa	$187,500 USAID	Cooperate with the South African Department of Trade and Industry to review policy and implementation of intellectual property rights in South Africa. Also cooperate with the Southern African Research and Innovation Managers Association to improve research and innovation at South African universities, universities of technology (technikons) and think tanks, as well as facilitating greater commercialization of research through the intellectual property rights system.
Ukraine WTO	Ukraine	$50,000 USAID	Assist Ukraine to adopt an intellectual property rights Omnibus Law to bring intellectual property laws and regulations into compliance with the TRIPS agreement.
Technical assistance on communication, arbitration and intellectual property rights	Dominican Republic	$15,000 USAID	Provide support for commercial arbitration and intellectual property rights management to make local laws comply with the TRIPS agreement.

Table 4.8 **EC financing for intellectual property technical assistance implemented by the EPO, 1990–2005**

Country/region	Period	Total budget (€)
China	1998–2001 2002–03	3,280,000 1,295,000
Viet Nam	1996–2000	900,000
Association of Southeast Asian Nations	1993–97 2001–05	6,400,000 6,400,000
India	2001–03	1,000,000
Eastern Europe	1990–2001	9,500,000
Commonwealth of Independent States Ukraine Uzbekistan	1996–98 1994–96 1995–97	1,000,000 270,000 400,000
Total	1990–2005	30,445,000

Source: Karachalios (2002).

Complementary donors and technical assistance providers

The involvement of non-governmental organizations and other civil society institutions in intellectual property technical assistance is fairly recent. Their role often consists of filling remaining gaps (providing advice on policy and legal reform, conducting policy research and encouraging dialogue). But they are also the main providers of assistance in the international negotiation process and have had considerable influence. For example, a strong coalition of intergovernmental organizations, civil society organizations and intellectual property experts helped developing countries translate their public policy concerns into coherent and concrete negotiating positions for TRIPS and public health as part of the Doha round. The coalition pressured developed countries through public campaigns to take better account of developing countries' concerns (Vivas-Eugui and Bellman 2004). Below follows a non-exhaustive list of some non-governmental organizations and research centres working in and with developing countries to enhance their knowledge and intellectual capacities.

Table 4.9 **IP Australia budgetary resources for intellectual property technical assistance, 2000–2003, by year (AUS$)**

2000–01	2001–02	2002–03	Total
836,000	705,000	671,000	2,212,000

Source: Communication from IP Australia in Pengelly (2004).

The South Centre. The South Centre, established in 1995, is an intergovernmental organization of 46 developing countries. Its objectives are to promote solidarity, common identity, mutual knowledge and understanding among developing countries; foster cooperation, action, networking and information exchange; promote the views and interests of developing countries on the global scene; and improve cooperation between developed and developing countries. It works above all on trade and development, as well as science and technology issues. At the World Summit on the Information Society in 2003 it, in partnership with the Diplo Foundation,[15] announced the forthcoming launch of its South-South Portal for Information, Knowledge and Empowerment (SPIKE).[16] Implemented with the financial support of the Swiss Development Cooperation Agency, SPIKE will be an information and knowledge portal aiming to contribute to the intellectual empowerment of developing countries. It should provide information in the form of bibliographies, references, databases, newsletters, analytical working papers and online course materials for developing country governments, universities and other higher learning institutions. It should also provide access to academic e-journals in developing countries and set up a network to link media and news agencies in developing countries.

The International Development Research Centre. Canada's International Development Research Centre (IDRC) is a leading institution in generating and applying new knowledge to meet the challenges faced by developing countries. Its objective is to provide financial and technical support to (indigenous) research and researchers in developing countries and to build their capacities to produce and apply knowledge for the benefit of their communities. Its research and capacity building programmes deal with three main areas: social and economic equity, environment and natural resource management, and information and communication technology for development. The IDRC works with many foreign development agencies—including the Canadian International Development Agency, DFID, the Ford Foundation and the Swiss Agency for Development and Cooperation. In 2003–04 it carried out 444 research projects, among them the Acacia programme (information support and assessment of information and communication technology for African countries), the G-24 research programme and related initiatives (research on global issues affecting developing countries to help them participate more effectively in international negotiations) and various monitoring and evaluation programmes.

The Quakers United Nations Office. The Quaker United Nations Office (QUNO), located in Geneva and New York, represents Quakers through the Friends World Committee for Consultation. The Quakers have consultative status with the United Nations Economic and Social Council as an international non-governmental organization working to promote peace, human rights and justice throughout the world. The Geneva office works on the promotion of trade, development and intellectual property, following closely the work of the International Labour Organization (ILO) and the WTO. The QUNO intellectual property–related objectives are to promote international agreements to ensure equitable access to and sharing of genetic resources; help developing countries, unrepresented workers, small farmers and indigenous people to be heard at the WTO; and facilitate dialogue and exchanges between non-governmental organizations, particularly those dealing with countries, communities and multilateral institutions. As part of its work programme to support developing countries' negotiating capacities—aiming to protect developing countries' genetic and traditional resources under patent rules—the QUNO recently organized a two-day seminar between developing and industrial country negotiators addressing TRIPS Article 27.3(b) to help developing countries strengthen their negotiating capacities and learn about requirements for their national legislation. It also produces reports, discussion papers and articles in English, French, German and Spanish to broaden perspectives and influence policy positions.

The African Agricultural Technology Foundation. The African Agricultural Technology Foundation, a non-profit foundation based in Kenya, is funded by the Rockefeller Foundation, USAID and DFID. Its objective is to help smallholder farmers in Sub-Saharan Africa gain access to agricultural technologies that could help improve food security and reduce poverty. For that purpose it seeks to acquire technologies along with associated materials and know-how from technology providers under royalty-free licenses, agreements and contracts. It also facilitates and establishes partnerships with public entities (African governments, African civil society, the international donor community, non-governmental organizations, research and development institutions) and the international and domestic private sector. Its mission is to ensure compliance with the laws on the use of these technologies, promote their distribution and enhance opportunities for research and technology transfer. Its capacity-building activities are totally demand driven and attempt to make up for the capacity gaps resource-poor farmers face in

acquiring and using the technologies they need, while contributing to establishing long-term links between technology users and providers.

Assessing the focus, level and coverage of current global capacity initiatives

This section offers a preliminary analysis of the current global effort in intellectual property capacity development. Given the lack of systematic data and the dispersion of the evidence available, this analysis can be neither exhaustive nor conclusive. But several general trends and opportunities for improvement may be identified. We first look into the current focus of the initiatives, the level of investment and the instruments and coverage of the programmes. Then we identify several opportunities for improvement, as they become apparent from the literature, experience and a comparison with other similar efforts, particularly trade capacity building.

Current focus on technical assistance is too narrow and not sensitive to the needs of developing and least developed countries. Current initiatives regarding intellectual property capacity development can be grouped in seven main areas (see table 4.10). Clearly, the WTO and WIPO concentrate on a smooth introduction and effective implementation of the intellectual property regime and the TRIPS agreement. Not surprisingly experts recognize that technical assistance is not often tailored to the special circumstances of developing countries. In addition to the work done by UNESCO, WIPO has been keen to bring up issues related to the protection of genetic resources, traditional knowledge and folklore, and other actors (notably UNCTAD and the IDRC) have joined in the effort to promote indigenous knowledge. Yet there is little (long-term) support for strengthening national innovation systems or supporting policy formulation and (international) negotiations. Multilateral and intergovernmental organizations and bilateral development agencies are generally not involved in building the negotiating capacities of developing countries.[17] In addition, policy and legislative advice does not necessarily embrace all the flexibilities and options available to developing countries (CIPR 2002; Pengelly 2003; Musungu 2003; Moon 2002).[18]

The insufficiency of technical assistance in building and strengthening developing countries' negotiation and policy capacities is particularly troubling because several multilateral and bilateral agreements on intellectual property will be up for (re)negotiation in the next few years. Likewise, financial and technical assistance in strengthening developing countries' innovation systems and helping local innovators and entre-

Table 4.10 **Main types of intellectual property rights technical assistance by main providers and donor organizations**

Type of technical assistance provided	Main providers and donors
Training and human resource development and intellectual property administration	• Intergovernmental organizations—WIPO/International Union for the Protection of New Varieties of Plants (UPOV), WTO, EPO, OAPI, ARIPO, World Bank • Bilateral donors—United States Patent and Trademark Office (USPTO), USAID, DFID, SIDA, CIDA • Business and lawyer associations—American Bar Association, the American Intellectual Property Law Association, the International Federation of Pharmaceutical Manufacturers Associations and the International Association for the Protection of Industrial Property
Legal and policy advice	• Intergovernmental organizations—WIPO/UPOV, WTO, EPO, UNCTAD, WHO, World Bank, South Centre • Bilateral donors—USPTO, USAID, DFID, SIDA, CIDA • Non-governmental organizations—ICTSD, Médecins Sans Frontières, Centre for International Environmental Law, Consumer Project on Technology, IDRC, Oxfam
Support to implement and modernize intellectual property rights administration offices	• Intergovernmental organizations—WIPO/UPOV, EPO, World Bank • Bilateral governmental donor agencies
Information services on intellectual property matters	• Intergovernmental organizations—WIPO, EPO • Bilateral governmental donor agencies
Research and analysis	• Intergovernmental organizations—UNCTAD, UNDP, WHO, OECD, World Bank, UNESCO, WIPO Convention on Biological Diversity (CBD), South Centre • Non-governmental organizations—ICTSD, QUNO, MSF, Oxfam, Centre for International Environmental Law (CIEL), Third World Network, Consumer Project on Technology
Promotion of innovation and creativity	• Intergovernmental organizations—UNCTAD, UNDP, World Bank, UNESCO, WIPO, International Trade Centre • Philanthropic organizations—Rockefeller Foundation, Ford Foundation and others • Academia—national academies of science and technology • Non-governmental organizations—ICTSD and others
Negotiation	• Intergovernmental organizations—South Centre, Advisory Centre on WTO Law, Agency for International Trade Information and Cooperation • Non-governmental organizations—ICTSD, QUNO, Consumer Project on Technology, MSF, Oxfam, CIEL, Third World Network, Southern and Eastern African Trade Information and Negotiations Institute

Note: This list must be considered preliminary and not exhaustive, because no systematic information is available for all agencies.
Source: Pengelly (2004); Vivas-Eugui and Bellmann (2004).

preneurs develop their research and development capacities and promote and market their own (technical knowledge-based) innovations is a prime requirement to enable those countries to participate more sig-

nificantly in the global knowledge economy.[19] Some capacity-building activities should thus aim at encouraging and helping developing countries use, share, export and benefit from their traditional knowledge. In that respect, traditional knowledge holders and indigenous communities should be more involved in the information, legislative and technical advisory and trade-related intellectual property activities of main technical assistance providers.[20]

Current initiatives for capacity development on intellectual property rights still closely resemble the rather narrow approach implied in article 67 of the TRIPS agreement. The joint effort has yet to be broadened to fully include such issues as developing national strategy, involving a wide array of stakeholders, creating an enabling institutional environment for innovation, stimulating the valorization, protection and appropriate use of national intellectual resources, and achieving full participation in global institutions, negotiations and processes that shape international intellectual property policy and the rules and practices of international intellectual property management. WIPO is moving on these issues, but it cannot do everything alone. Its efforts need to be

Box 4.4 The changing focus of technical assistance—the trade policy example

Stage 1—ad hoc technical assistance. Focus on single missions. Technical assistance is often provided as a hit-and-run activity, frequently with paternalistic overtones. The emphasis is on transferring solutions, with the underlying assumption that low-income countries should follow the development model of industrial economies from 1945 to the late 1950s.

Stage 2—technical cooperation. Technical assistance acquires more conceptual and comprehensive underpinnings. It is conceived as integral to international development aid and delivered by specialized agencies. Trade-related technical assistance activities are initiated or reinforced by the GATT/WTO, UNCTAD, International Trade Centre, World Bank, OECD, national agencies and non-governmental organizations. The time scale is usually short and beneficiaries have limited involvement in programme design. Quality is evaluated mainly by the providers, if at all.

Stage 3—capacity building. The idea gains ground as an innovative concept and technical assistance strategies are developed from the broader perspective of sustainable development. The approach is based on the assumption that technical assistance should be performed by networks involving a variety of actors, all contributing skills and resources to the process—which relies on partnership with the beneficiaries and shared experience rather than transferring solutions. Beneficiary orientation and long-term programmes are given higher priority. Quality is of concern to technical assistance providers, beneficiaries and donors.

Source: Kostecki (2001).

complemented by and coordinated with other donors and institutions and in collaboration with developing countries concerned.

In fact the effort requires for intellectual property rights a shift similar to the one that occurred in capacity development for international trade, since the international community started to incorporate development in its trade agenda more explicitly (see box 4.4). Today, as in the early days of trade, intellectual property assistance is mainly technical assistance and technical cooperation and does not yet aim to strengthen the capacity of developing countries to make use and benefit from the international intellectual property regime.

Global investment: lack of clarity and clearly insufficient

Any estimate of global investment in intellectual property technical assistance, cooperation and capacity development initiatives is difficult to make. Not only are reliable data scarce, comparability is often hard to establish. Donors also tend to use different time frames for reporting. Besides, figures on intellectual property technical assistance for the UNDP, UNESCO, UNCTAD, World Bank,[21] WTO,[22] ARIPO and OAPI are not available publicly. The main source of information on intellectual property technical assistance is the WTO/OECD Trade Capacity Building

Table 4.11 **Total investment in intellectual property technical assistance by donors and providers (€ millions)**

Donors/providers	2000–01	2002–03
WIPO	45.6	59.1
EPO	7.2	—.
IP Australia	0.7	0.6
USAID (technical assistance for the TRIPS agreement)	5.9	11.8
Trade capacity building database (technical assistance for TRIPS reported)	11.6[a]	8.0[b]
Estimated total[c]	71.0	79.4

Note: Conversion rates as of 12 September 2003 were: $1.00 = €0.89509; CHF 1.00 = €0.642; AUS$1.00 = €0.59.
— Not available.
a. Funds invested in 2001. No figures exist for 2000.
b. Funds invested in 2002. Figures for 2003 were unavailable.
c. It is very likely that the investments by IP Australia and USAID are calculated twice in this total, since both have been reporting their expenditures to the database.
Source: Figures adapted from various sources, including WTO, WIPO, EPO Annual Reports and the Doha Development Agenda and USAID Trade Capacity building Database.

Database.[23] The database gives some statistical information on technical assistance linked to TRIPS, but is still incomplete. For example, it covers only 2001, 2002 and part of 2003. Its information derives mainly from bilateral donor agencies and the WTO. The technical assistance provided by WIPO or EPO, for instance, is not included, so the amount of intellectual property technical assistance indicated is underestimated.

Nevertheless we attempt an overview of the global assistance effort regarding intellectual property, based on the data currently available (see table 4.11). IP Australia and USAID's expenditures might be calculated twice in this total,[24] and data from other major multilateral and bilateral donors and from the non-governmental organizations are missing. Sometimes, the lack of specific information on intellectual property technical assistance means that technical assistance and capacity building activities are integrated into wider projects or programmes of a particular donor, without a clear specification of the budget dedicated to intellectual property (this is the case for the World Bank, for instance). Moreover, the efforts and expenditures for programmes on traditional knowledge—its protection and defence, but also its promotion, valorization and trading—and for the promotion of innovation and creativity are generally hard to quantify, while returns on investments are visible only in the long term. But we may conclude that WIPO is by far the largest donor for intellectual property technical assistance, providing up to 75% of total expenditures for 2002–03.[25]

In addition to the limited data, the lack of evaluation of technical assistance and capacity building programmes makes it difficult to assess the impact and effectiveness of such assistance (CIPR 2002; Pengelly 2003, 2004). The assessment is further complicated by the large number of agencies involved—from international organizations to bilateral donor agencies, civil society institutions and non-governmental organizations—that often undertake small-scale activities (workshops, information, analytical papers), the effect of which is hard to measure.

The second WTO/OECD Report on Trade-Related Technical Assistance (2003) showed that the funding for technical assistance dedicated to TRIPS each year is very limited—and decreasing (see table 4.12). In 2001 donor expenditures on intellectual property technical assistance were estimated at US$13 million (11.6 million), with 53 activities reported. This corresponds to 0.60% of all expenditure dedicated to trade capacity building and to 1.68% of all activities undertaken in 2001. In 2002 the number of activities increased to 99 (2.57% of all trade capacity building activities), yet total assistance had fallen to US$9 million (8 million). The

Table 4.12 **OECD/WTO Doha Development Agenda, Trade Capacity Building Database**

Main trade-related technical assistance and capacity building areas	Funds (US$ million)		Number of activities	
	2001	2002	2001	2002
Trade Policy and Regulations	*727*	*712*	*1,415*	*1,855*
33111—Trade mainstreaming in Poverty Reduction Strategy Papers/development plans	94	73	201	233
33112—Technical barriers to trade and sanitary and phytosanitary measures	127	58	143	237
33121—Trade facilitation procedures	214	194	202	267
33122—Customs valuation	4	17	43	57
33123—Tariff reforms	0	0	6	7
33130—Regional trade agreements	57	163	37	66
33141—Accession	12	25	61	41
33142—Dispute settlement	1	1	23	26
33143—Trade-Related Intellectual Property Rights (TRIPS)[a]	13 (0.60% of total)	9 (0.43% of total)	53 (1.68% of total)	99 (2.57% of total)
33144—Agriculture	10	6	38	49
33145—Services	5	18	34	76
33146—Tariff negotiations, non-agricultural market access	6	3	85	78
33147—Rules	9	2	24	38
33148—Training in trade negotiation techniques	6	8	20	32
33151—Trade and environment	80	34	69	88
33152—Trade and competition	41	31	47	69
33153—Trade and investment	9	11	24	35
33154—Transparency and government procurement	2	2	5	18
33181—Trade education and training	37	56	300	338
Trade Development	*1,432*	*1,383*	*1,732*	*1,992*
25011—Business support services and institutions	575	449	872	764
25012—Public-private sector networking	27	28	38	58
25013—E-commerce	2	37	29	64
24000—Trade finance	410	334	158	195
A30000—Trade promotion strategy and implementation	229	287	360	473
B30000—Market analysis and development	189	248	274	438
Total annual trade capacity building	*2,159*	*2,095*	*3,157*	*3,847*

a. The WTO-OECD Database defines trade-related technical assistance to TRIPS as: "(i) implementation of legislation which is consistent with the TRIPS Agreement; (ii) modernization of intellectual property offices and collective management societies; (iii) strengthening of the means to enforce rights; (iv) promoting and encouraging technology transfer to least-developed countries and the use of intellectual property systems for development purposes; and (v) issues under discussions/negotiation in the WTO."
Source: WTO-OECD TCB Database 2004. http://tcbdb.wto.org/trta_subcategory.asp?cat=331&subCat=43

funds then allocated to capacity building for TRIPS represented 0.43% of all trade capacity building funds. This would suggest a move towards more and smaller activities. But as stated above, the figures do not cover all the technical assistance activities undertaken by the many bilateral and multilateral donors and non-governmental organizations. Nonetheless, the global financial effort in assisting developing countries to achieve full participation in the international intellectual property system is limited, while the technical assistance itself tends towards smaller scale activities.

In conclusion, we calculate that biannually about 80 million is dedicated to assist developing countries in building and updating their intellectual property systems and legislation to comply with international laws. This investment is clearly insufficient to help all developing and least developed countries install adequate capacity to fully participate in designing, implementing and drawing maximum benefits from the global intellectual property regime. This is all the more so because support consists essentially of technical assistance—a rather short-term and narrowly defined approach, and not so much a long-term effort to help developing and least developed countries build their capacities in a broad sense. In 2002 the World Bank estimated that an upgrade of the intellectual property rights regime, including training costs, would require at least $1.5–2 million per country (World Bank 2002). Given the need for a more comprehensive and long-term approach to developing national and international capacities of developing and least developed countries on intellectual property management, this is definitely an understatement.

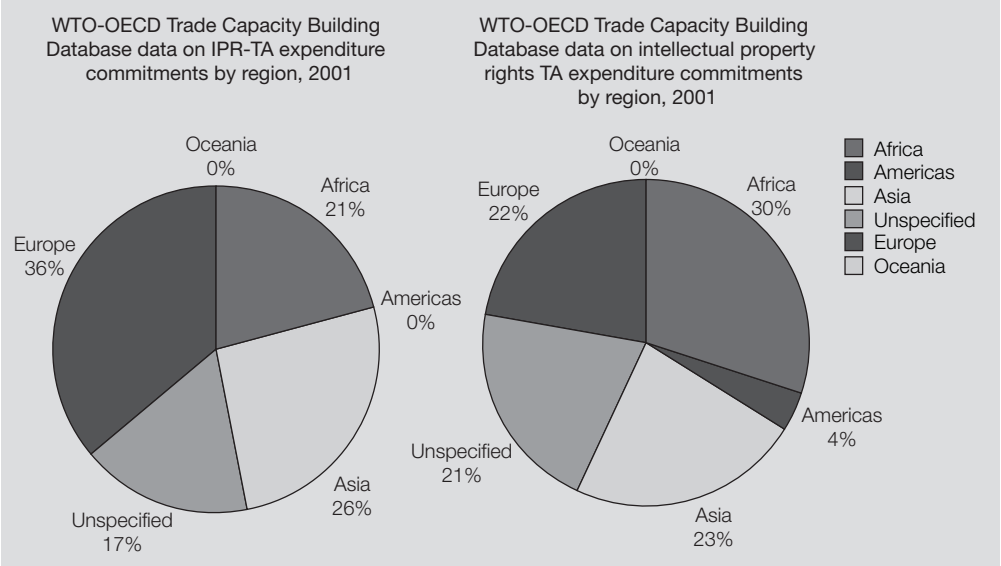
Regional coverage: not inclusive, not global. Intellectual property technical assistance has proved very useful as a first step. Generally, developing and least developed countries lack knowledge, infrastructure and human expertise in intellectual property management. Significant progress has been observed in terms of developing human resources to deal with intellectual property issues and modernizing intellectual property infrastructure (especially through WIPO's Worldwide Academy, launched in 1998, and the WIPONet programme, started in 2001). Latin American and Eastern European countries are where intellectual property technical assistance has been most effective in terms of human resource and infrastructure development—along with countries such as China, India, Morocco, Trinidad and Viet Nam, as well as the two African regional organizations, the OAPI and ARIPO, which have also significantly developed their institutional capacities (Pengelly 2003, 2004).

Table 4.13 **WTO-OECD Trade Capacity Building Database data on technical assistance expenditure commitments and activities by region, 2001–02**

Region	Commitments ($)		Activities	
	2001	2002	2001	2002
Africa	2,718,000	2,846,000	10	59
Americas	41,000	343,000	8	19
Asia	3,396,000	2,138,000	28	77
Europe	4,679,000	2,012,000	7	16
Oceania	7,000	45,000	2	6
Unspecified	2,264,000	1,921,000	9	19
Total	13,105,000	9,305,000	64	196

Source: Pengelly (2004).

Figure 4.1 **WTO-OECD Trade Capacity Building Database on intellectual property rights technical assistance expenditure commitments by region, 2001 (Pengelly, 2004: 55, 57)**



The recent launch (in 2001) of the database does not allow confirmation of whether a shift in the regional allocation of technical assistance has taken place. In 2002 expenditures on intellectual property technical assistance seem more evenly distributed among the African, Asian and European regions than in 2001 (see table 4.13; figure 4.1). But this is because expenditures in Europe and Asia decreased, not because more funds were

granted for building capacity in Africa. Assuming that in Africa needs are greater, this is not reflected in the allocation of resources.

Analysing the data for the technical assistance delivered to Africa in 2001 and 2002 a bit further, it becomes apparent that TRIPS-related technical assistance was provided to 17 countries, with Egypt receiving 67% of the total funds and Nigeria and South Africa receiving 8% and 10%, respectively. Fourteen African countries shared 15.3% of the funds for building their capacities in relation to the TRIPS agreement. There was no record of assistance for the remaining countries. Based on the data available, the United States provided 87.5% of the funds. WTO activities represented 6.16% of the total funds. Among the 34 activities accounted for, 11 were seminars, conferences or workshops, 5 aimed at institution building and 5 focused on staff training.

This appraisal is not totally accurate because bilateral donors may not have reported all their activities and expenditures commitments, or may have split a regional activity over one or two beneficiary countries, or may have reported an activity component instead of the entire activity. Yet it does give an idea of the uneven delivery of assistance to developing and least developed countries. Hence, the fact that the United States provides 87.5% of the funds for technical assistance in Africa does not necessarily mean that it provides a lot more assistance than other donors; it may be the only donor to have regularly provided its data to the database. We can assume though, that the United States—among others—provides technical assistance to the countries it has special commercial ties and interests with.

Evaluation and monitoring: not a priority. In an insightful study Pengelly (2004) looks into technical assistance for the formulation and implementation of intellectual property policy in developing and transition countries, providing an overview of the design, financing, delivery and evaluation technical assistance. His study includes a literature review, a Web site survey, a survey of main donor organizations and interviews with developing country representatives at the WIPO assemblies in Geneva in September 2003. He presents five case studies—on the EOP, European Commission, IP Australia, the United States and WIPO.

Pengelly concludes that neither US governmental agencies (USAID, US Patent and Trademark Office and the Department of Trade, among others), the European Commission nor the EPO were undertaking or publishing evaluations. Neither did they have or envisage any specific arrangements for monitoring and evaluating their technical assistance

programmes or for modifying their programmes on the basis of lessons learned from experience. A first conclusion may be that little is known systematically about the intellectual property capacity development initiatives, their outcomes and impact—a conclusion that may be confirmed on the basis of the experience with this study.

Opportunities for improving capacity development for global intellectual property management. The Commission on Intellectual Property Rights' report states that "There is a great deal of scope for improvement in the delivery and coordination of assistance in the intellectual property field. Much money has been spent in various ways by many different institutions but the results do not seem commensurate with the effort" (CIPR 2002, p. 169). This assessment confirms both the need for improvement in and the scope of the approach, level of funding, coverage and depth of current initiatives, as well as for increasing effectiveness and efficiency. We briefly touch on our conclusions in each of these areas before formulating more specific suggestions.

Global initiatives have mostly adopted a narrow approach to capacity development. They focus on creating minimum legal and administrative conditions for smooth implementation of the international intellectual property regime in selected countries, instead of investing in the full range of capacities needed to allow developing countries to become full partners in the global management of intellectual property. Technical assistance, while necessary, is insufficient for full participation of developing countries in the global management of intellectual property. It seems to reflect short-term donor country interests more than the wish to ensure adequate participation of developing countries in the design, negotiation and use of the international intellectual property regime, in line with MDG 8.

The coverage of current initiatives, while not exhaustively documented, seems to reflect rather closely the particular, short-term interests of donor countries and agencies. In addition, no systematic attention seems to be paid to the severe challenges in least developed countries.

Furthermore, the many challenges developing countries face confirm the urgent need to increase financial support to intellectual property capacity building substantially and to respond to developing countries' particular needs in terms of capacity building for intellectual property management (see box 4.5). As members of the WTO and other international organizations, developing countries are required and expected to choose from different policy options they are presented with—that is, to weigh

Box 4.5 The UNDP capacity development platform: principles for developing intellectual property capacity

Through its partnerships in the different regions of the world, some key principles can be highlighted from UNDP's experience, including:

- Consider capacity development an ongoing process.
- Ensure ownership for local and national actors (define their own needs and implement their own solutions).
- Craft urgent carefully integrated responses to short-term poverty concerns and longer term sustainability issues.
- Ensure civic engagement and sound participatory processes in the design, implementation and monitoring of social, economic and environmental policies and practices (support networks and dialogue with local leadership).
- Adopt a flexible approach, allowing for different emphases in response to varying sustainable development priorities among different communities, countries and regions.
- Develop existing capacities rather than replace them.
- Recognize, respect and integrate cultural identities and values.
- Review national and local policies and legislation, eliminating bottlenecks and ensuring incentives for local sustainable development.
- Promote information and communications systems, helping communities participate in decisions governing their involvement in the global economy.
- Promote broad participatory platforms for designing, implementing and monitoring strategies, plans and other such instruments.
- Develop functional partnerships, networks and strategic alliances involving communities with national, regional and international partners that can support local capacity development and emphasizing the key role of networking in knowledge acquisition.

Source: UNDP Capacity 2015 Web site, http://www.capacity.undp.org/index.cfm?module=ActiveWeb&page=WebPage&s=hhhh

advantages, disadvantages and trade-offs; build alliances; and choose the option(s) best suited to their national circumstances. The next four to five years will see a large number of international events in which the legitimacy of decisions taken and agreements reached will depend on effective participation by developing countries.[26] Moreover, many developing countries are increasingly involved in regional and bilateral agreements on intellectual property. Negotiating those agreements with different bilateral partners with different intellectual property requirements and enforcing their legislation accordingly draws on limited human, financial and technical capacities. But developed countries often try to impose stricter intellectual property rights than required under the TRIPS agreement, and they do not necessarily grant developing countries as much flexibility and as many exceptions as multilateral agreements do.

Support for national research and analysis, innovation and research and development capacity, creativity and negotiation strategies and

Box 4.6 Specific recommendations to improve delivery of intellectual property–related technical assistance

- Deliver technical assistance through multi-year, broad-based programmes (not just short-term, one-off events).
- Assistance should cover support for expenditures such as office space, automation, equipment, communications, staff training, consultancy support, international travel, public awareness-raising programmes, patent information systems, Web site development, policy research and legislation development.
- Aim for financial sustainability of intellectual property institutions as a key objective from the outset.
- Involve a wide range of stakeholders.
- Expand donor commitments to intellectual property technical assistance programmes in developing countries over the next 5–10 years. The funding could be obtained from the income generated from intellectual property rights service user fees in developed countries and at WIPO.
- Strengthen donor systems for monitoring and evaluating intellectual property technical assistance programmes. They should undertake and publish a rolling programme of external impact evaluations.
- Address concerns regarding the appropriateness of intellectual property technical assistance. WIPO should develop detailed due-diligence procedures for its staff and consultants on providing technical assistance to developing countries for reform of domestic intellectual property legislation, including for implementation of the TRIPS agreement.
- Experts, donors and developing countries should develop better donor coordination and best practices for intellectual property technical assistance based on detailed case studies on developing countries and regions. The output would be a set of detailed guidelines for improving the delivery of such assistance, but the process would also be useful in improving dialogue and information sharing among donors.

Source: Pengelly (2003).

skills are gradually being provided by intergovernmental institutions and particularly non-governmental organizations but, as incomplete data suggest, the intensity and range of the joint effort is far from sufficient (Juma 2001). Improvement in the design and delivery of intellectual property technical assistance is urgently needed if it is to respond more effectively to the needs and expectations of developing countries (CIPR 2002; Pengelly 2003).[27]

A field that certainly merits particular attention is the protection of traditional knowledge or, as Stiglitz (1999) calls it, the global knowledge commons. The legitimacy and acceptance of international conventions on the management and use of intellectual property rights seems to be directly related to the protection these conventions provide to indigenous knowledge and resources. Such protection requires in-depth, long-term investment in the capacity of government and non-government institutions, in regulatory frameworks and in enforcement mechanisms in developing countries.

Next, our assessment provides ample basis to argue that there is a need for better organization, planning, coordination and management

of global capacity development efforts to increase their effectiveness and efficiency. In particular, current programmes seem to lack systematic assessments of each developing country's needs as well as systematic monitoring and evaluation of results and outcomes. This may also be expected to have a negative impact on learning, limiting the opportunities for agencies to draw and share lessons from experience.

Finally, there is a distinct need for improved governance and coordination by international organizations. More emphasis should be given to strengthening the long-term capacity of developing countries, not only to prepare national strategies and negotiate them but also to identify and apply the benefits of the system. This would imply building capacity for intellectual property management in national research and development and intermediary knowledge institutions, both private and public, and in indigenous communities, civil society and government institutions, with a view to achieving adequate management of national intellectual resources (see box 4.6).

Recommendations

The evidence on the effectiveness and impact of developing intellectual property capacity is neither exhaustive nor conclusive. The scope of this chapter did not permit general consultation with relevant stakeholders. Nevertheless the assessment here points to the need to intensify global capacity initiatives on intellectual property management—to make them more comprehensive, more inclusive and more deeply rooted in the (civil) societies of developing countries. With this in mind, we make five recommendations.

1. Redefine capacity development for global management of intellectual property, taking into account the lessons learned in trade capacity building.

In line with the definition of trade capacity building in the joint WTO/OECD Trade Capacity Building Database, capacity initiatives would then address not only short-term implementation concerns but also a wide range of abilities the participating members need:

- To formulate and implement an intellectual property development strategy, actively involving the private sector, civil society and research and development and intermediary knowledge institutions.

- To create an enabling institutional and business environment for improving the management and value added of intellectual property, diversifying innovative products and markets and increasing investment in national research, technology and innovation.
- To stimulate appropriate intellectual property management by domestic communities and firms and encourage investment in the development and marketing of innovations.
- To participate in and benefit from the institutions, negotiations and processes that shape international intellectual property policy and the rules and practices of international intellectual property management.

2. Ensure that WIPO and WTO intellectual property capacity programmes are more inclusive and more sensitive to the needs of developing countries, particularly least developed countries.

The limitations of both WIPO and the WTO should be recognized. Intellectual property technical assistance, while necessary, is not sufficient to create the conditions for truly global management of intellectual property rights. Strengthening their programmes should therefore include the following efforts:

- WIPO and the WTO need to include a wider constituency of policy-makers, scientists and civil society groups, particularly from developing countries, in the governance of their capacity development programmes.
- WIPO, the WTO and other agencies should provide technical assistance and information programmes to all developing countries, particularly the least developed countries.
- WIPO and the WTO should further develop and strengthen regional programmes and initiatives, particularly for developing countries.
- WTO members (and the WTO itself) should clearly outline the flexibilities included in the TRIPS agreement and enable developing countries to use these. The WTO and its members should also revise their intellectual property legislation.
- WIPO should increase technical assistance to least developed countries that require special assistance in developing their intellectual property regimes. It should also increase training of administrative staff.[28]

- WIPO, the WTO and other agencies need to ensure consistent participation of developing countries in setting agendas and making decisions, including expert delegations to attend meetings and to report to national governments and support for policy analysis, coordination and discussion.
- WIPO needs to strengthen its initiative to link up with research and development institutions, universities and relevant government bodies, particularly in least developed countries.
- WIPO should assist least developed countries in establishing an informal group to enable them to discuss technical issues among themselves and with WIPO.

3. Mandate and adequately fund a global intergovernmental institution to lead and orchestrate long-term global efforts for intellectual property capacity development.

WIPO could be an appropriate candidate, especially now that it has agreed to set up a development agenda. UNESCO could also be considered, given its global mandate and legitimacy, its engagement with global education and its long-standing experience with the defence and promotion of culture and cultural heritage and of traditional knowledge holders. The UNDP has demonstrated a more comprehensive view of capacity development that also provides a good base for further activities. Tasks of the lead agency or anchor institution:

- Design, supervise and support systematic in-country needs assessments for intellectual property capacity development as a basis for planning national and international capacity initiatives, working closely with state and non-state actors and national stakeholders in developing countries.
- Design, orchestrate and monitor a comprehensive global programme of capacity development for intellectual property management, ensuring reform processes are development oriented, working closely with donors, national governments, intergovernmental institutions and international organizations.
- Encourage developing country governments to strengthen the participation of state and non-state actors in national and international debates and decision-making about intellectual property; and encourage donors to support the articulation of stakeholder platforms at different levels with relevant information systems.

- Encourage developing country governments to enhance national institutional capabilities for intellectual property regulation and management, involving a wide range of stakeholders from the private sector, civil society and government.
- Encourage donors to support developing country governments in strengthening national policies, institutions, innovation systems and research and development regarding (potential) effects and benefits of intellectual property agreements. Particular attention should be paid to the involvement of small and medium enterprises.
- Encourage donors to focus their efforts on strengthening the capacities of national policy and research institutions in developing countries to enable these countries to undertake intellectual property policy research and dialogue with national stakeholders, to propose strategic options and to encourage them to build and maintain expertise in this field.
- Strengthen national and international networking and learning on good practice in intellectual property capacity development, policies and institutions and situation-specific effects of agreements that affect developing countries and least developed countries.
- Design and operate a system for monitoring and evaluating global efforts for intellectual property capacity development, knowledge transfer and use and for measuring the impact of international agreements on developing countries, particularly least developed countries.

4. Significantly increase long-term financial commitment and support by donors to intellectual property capacity development in developing countries, particularly for least developed countries.

5. Improve the global governance of the intellectual property regime.

In line with specific recommendations being formulated by the Joint WIPO-WTO African Workshop on the implementation of the TRIPS agreement and technical assistance to least developed countries (see box 4.7), long-term capacity objectives should include:

- Increasing effective participation of developing countries in deliberation and decision-making forums at the national, regional

Box 4.7 **Recommendations from the joint WIPO-WTO African workshop on implementing the TRIPS agreement and Technical Assistance Initiative to Least Developed Countries**

This workshop was held in Tanzania on 22–25 April 2002 in the framework of the WIPO-WTO Joint Technical Assistance Initiative to Least Developed Countries. About 140 African senior officials from trade, industry and finance ministries attended the workshop with international and regional experts and members from the OAPI and ARIPO. Participants received a clear presentation of the obligations and options allowed under the TRIPS agreement and the Doha declaration, as well as the steps to be taken at a national level to comply with them. Some needs identified included:

- Stronger administrative systems and the means to implement effective intellectual property protection.
- More development and training of human resources.
- More financial and technical support to build stronger intellectual property infrastructure.
- Improved institutional and policy framework for modernizing and developing the intellectual property systems of least developed countries.
- Augmented assistance to help least developed countries improve their competitiveness and ability to gain regular access to ideas, technologies and funds.
- Greater efforts to facilitate the transfer of knowledge in favour of least developed countries and intensify the global contribution to poverty reduction.
- Stronger copyright systems in least developed countries.
- More active participation by developing countries in deliberation and decision-making forums on traditional knowledge, folklore and genetic resources and general intellectual property debates and by technical knowledge holders at national, regional and international levels in formulating strategies (policies, plans, mechanisms) for regulating access to and benefit-sharing in protection of their knowledge and resources.
- Stronger cooperation between the OAPI and ARIPO and between their member states.
- WIPO financing of more national delegations from least developed countries to increase their participation in WIPO expert meetings.
- WIPO assistance in establishing an informal group of least developed countries to enable them to discuss technical issues among themselves and with WIPO.

Source: WIPO Permanent Committee on Cooperation for Development Related to Intellectual Property (2002).

and international levels on traditional knowledge, folklore and genetic resources and in general intellectual property debates.

- Increasing financial and technical support for improving national capacities in developing countries to effectively formulate strategies for regulating access to and benefit-sharing in protection of their knowledge and resources, with particular reference to national information and communication systems.
- Deepening participatory processes in developing countries with respect to formulating intellectual property strategies and managing intellectual property agreements, involving a wide range of stakeholders, respecting and valuing diverse cultural identities and strengthening human resource development and training.

- Augmenting the assistance to least developed countries to improve their competitiveness and access to knowledge and funds for innovation.
- Increasing financial and technical support to build stronger intellectual property infrastructure, with particular attention to the financial sustainability of intellectual property institutions.
- Improving the institutional and policy framework for developing and managing intellectual property systems to include protection of national and traditional intellectual property, particularly in least developed countries.
- Increasing donor and non-governmental organization support for centres of excellence in developing countries and developing country-inclusive networks of universities, research centres, intermediary organizations and the private sector to enable them to identify and exchange innovative experiences and ideas at the national, regional and global levels.

Annexes: Inventory of main findings and related specific recommendations

The following three annexes summarize the main points of the analysis made in this paper, as well as the recommendations derived from this analysis:

Annex 1: Capacity building for intellectual property: elements of good practice

Annex 2: Capacity building for intellectual property: difficulties encountered in current practice

Annex 3: Indicative recommendations on capacity building for intellectual property as a global public good

Annex 1. Capacity building for intellectual property: elements of good practice

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Kinds of activities	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	
Performance objectives (required capabilities)	- Intellectual property strategy conducive to development objectives - Intellectual property strategy effective in valorizing, protecting and mobilizing indigenous resources - Coherent intellectual property strategy at the national, bilateral, regional and multilateral levels - Effective consultations with stakeholders - Effective intragovernmental policy coordination - Effective policy inputs from networks of research and academic institutions	- Agreements support development objectives and major goals outlined in intellectual property strategy - To achieve provision of the global public good (knowledge and the international intellectual property regime) that is conducive to development objectives - Ability to adjust positions to match the dynamics of negotiations - Effective ongoing support from national experts and research and academic institutions	- Ability to implement and benefit from the intellectual property agreement, and to participate in its enforcement - Increased efficiency, expanded markets, better integration into the world knowledge economy - Smooth adjustment process - Infrastructure effectively supports intellectual property system - Institutions enable the effective operation of the intellectual property system (for example, government agencies and policy networks, including indigenous research institutions)	- Ensure legitimacy of international institutions and agreements - Facilitate participation of all countries (including LDCs) in the international intellectual property regime - Effectively incorporate views and needs of countries, even the weakest, into the negotiation process - Assist developing countries in developing their capacity to prepare for, participate in and evaluate negotiation processes - Assist developing countries in implementing and benefiting from agreements once signed - Assist developing countries in enforcement mechanism (such as resolving disputes) - Provide sufficient means to international institutions to carry out their mandate - Stimulate coordination, complementarity and coherence of international institutions and agreements

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Kinds of activities	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	
Capacity objectives	- To map out the country's (knowledge) resources and innovative strengths and appreciate them in light of national development objectives - To do basic research and analysis of the current situation and potential benefits - To carry out effective consultations with stakeholders - To coordinate policy among government ministries - To collect, disseminate and analyse (international) statistics and other information - To develop an intellectual property strategy that is coherent with national development priorities and available resources - To support outward-oriented national and regional strategies	- To defend country strategy and to achieve major goals set - To analyse and adjust to positions of opponents - To be able to identify, form or join alliances that support essential elements of country strategy - To gain respect for protection of national (knowledge) resources	- To implement or comply with agreements or international commitments - To develop adequate infrastructure - To establish and maintain appropriate institutions including platforms and networks to support intellectual property management - To develop and maintain links with the private sector and between the private sector and government - To create a favourable business climate, enabling creative and innovative national industries	- To ensure that results of negotiations are credible and have legitimacy - To manage an inclusive process (with all developing countries) - To support implementation in ways that maintain credibility - To have institutions deliver on respective mandates - To ensure coordination, complementarity and coherence among international organizations and programmes

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Kinds of activities	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	
Processes	- Understanding system supporting intellectual property regimes - Understanding political nature of capacity development - Looking for strengths and opportunities in the international intellectual property regime and national capacity, not just weaknesses or gaps - Helping countries set priorities - Ensuring participation of stakeholders - Providing intellectual and institutional space for innovation and learning - Protecting against destructive influences (politics, corruption, etc.) - Building on local ownership - Encouraging both soft and hard capabilities - Generally strengthening established mechanisms rather than creating new ones - Untying assistance - Ensuring mutual accountability—donor to recipient and vice versa	- Strengthening legitimacy of the negotiation process and its outcomes - Feeding into ongoing intellectual property policy-making processes - Facilitating and supporting participation in negotiations - Ensuring timely response to emerging demands for support and analysis during the negotiations - Avoiding “donors bias” by insulating donor support from strategic negotiations - Recognizing relationship between capacity on the part of all participants and the possibility to make legitimate progress	- Ensuring responsiveness to emerging needs - Designing monitoring and evaluation systems for local learning - Securing sustainability through interconnectedness among organizations involved - Enabling conditions for innovative entrepreneurship in manufacturing, services and creative industries	- Avoiding capture by special interests - Preventing politicization and instrumentalization of international institutions - Facilitating participatory approach - Ensure coherence and complementarity of institutional approaches to intellectual property policy matters, in a way consistent with development objectives - Ensuring respect for national development priorities of developing countries - Ensuring respect for sustainable management of indigenous resources

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Kinds of activities	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	
Roles	- Countries define their needs, identify assistance required and take charge of their intellectual property strategy and development - Donors support long-term development of capacity and provide long-term commitment - Donors play role of catalyst, supplier of resources and information, buffer against outside forces, but not implementer - Donors help build confidence in recipient country - Donors are unbiased suppliers			- Provide advice and support to country - Help provide a policy space - Avoid top-down approach

Annex 2. Capacity building for intellectual property: difficulties encountered in current practice

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Kinds of activities	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	
End objective	- Developing countries prepared for negotiations	- Developing countries participate in negotiations - Developing countries accept and are able to cope with the international intellectual property regime, and its further elaboration	- Developing countries implement national and international intellectual property regimes	- Put in place international intellectual property agreement with commonly agreed norms

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Kinds of activities	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	
Real situation	- Supply-driven intellectual property capacity building: Perception in many developing countries that international intellectual property regime is thrust on them - Little consultation with stakeholders - Gap filling intellectual property technical assistance focuses on short-term output, rather than long-term capacity building - Little attention to and hence improvement of sustainable national capacity - Inadequate capacity to do relevant analyses - Inadequate statistical base for solid analysis - Poor coordination in government - Focus on short-term negotiations rather than sustainable intellectual property and development strategies - Technical assistance and capacity building activities in the form of training, workshops and studies, focusing on short-term hard capabilities - Insufficient attention to critical issues and challenges emerging from developing countries and LDCs	- Process has little legitimacy - Reduced legitimacy of agreements and institutions because many countries are not able to fully engage in the negotiations (not full partners) - Ineffective negotiations process - Developing countries often unable to protect their interests	- Developing countries often mainly rule-takers - Lack of capacity to benefit from agreements: supply constraints, inadequate infrastructure, weak support institutions, lack of linkages within private sector or between private sector and government - Lack of capacity to enforce agreements within countries - Countries can be punished for non-compliance with agreements due to lack of capacity	- Little attention to needs of developing countries - No systematic assessment of needs - Inadequate capacity of international institutions to carry out their mandate and to assist developing countries in their intellectual property negotiation process and implementation - Focus on intellectual property negotiations at the expense of broader development objectives - Lack of monitoring and evaluation of technical assistance and capacity building programmes

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Kinds of activities	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	
Nature of Support	- Supply-led capacity building for intellectual property, pushed by industrial countries - Little clearly articulated demand from developing countries - Donors provide assistance to support certain outcomes (such as implementation of TRIPS Agreement without reform) - Donors make few links between capacity building for intellectual property and overall development assistance - Lack of coherence in donor policies that affect developing countries - Donors tend to emphasise operational results over an above developmental results	- Many developing countries depend heavily on intellectual property technical assistance provided by donors - Little involvement of private sector and civil society - Lack of coordination among ministries - Some countries do not have permanent representation at the WTO/WIPO - Poor coordination between WTO/WIPO delegation and capital officials	- Hardly any binding commitment in international agreements to intellectual property capacity building for implementation purposes - Little support provided for sustainable implementation - No systematic involvement of non-state actors	- International organizations have insufficient means to support developing countries - Current initiatives coverage limited to a proportionally small number of developing countries - Still insufficient coordination among donor agencies - Lack of capacity of many developing countries to ensure enforcement of agreements or participate effectively in negotiations

Annex 3. Indicative recommendations on capacity building for intellectual property as a global public good

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Type of capacity	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	**Required international governance conditions for support**
On focus	- Policy and capacity building for intellectual property should be integrated into broader sustainable development objectives and strategies - More emphasis on building domestic capacity (intellectual property policy-making and research and development process) rather than simply focus on task completion (development of a intellectual property strategy document): this may require parallel streams of assistance for the two objectives - National, bilateral, regional and multilateral dimensions of intellectual property policies, and hence capacity building for intellectual property, should be better integrated, to avoid excessive fragmentation of capacity building for intellectual property programmes on similar issues - More emphasis on promotion of innovation and creativity	- All developing countries able to participate in negotiations of the international intellectual property regime - Identification of synergies among various forum of negotiations - Support to developing country coalitions	- Developing countries' commitments at the international level should match their implementation capacity and capacity building for intellectual property support - Promote regional and international cooperation on implementation issues - Increase financial and technical support to developing countries and LDCs to access knowledge, ideas and funds for innovation and promote their own knowledge and knowledge-intensive products	- Focus on the legitimacy of the international intellectual property regime - Presence of all developing country representatives at the negotiations, both ministerial and other high political and technical meetings and WIPO delegation in Geneva - Complementarity among international organizations dealing with intellectual property issues (WIPO, WTO, UNESCO, UNCTAD, EPO, UNDP, World Bank, regional intellectual property institutions) - WIPO to assist in the establishment of an informal group of LDCs in WIPO

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Type of capacity	Design and strategy development	Negotiation	Implementation and utilization	Required international governance conditions for support
On process	- Need to differentiate programmes better between short-term technical assistance and longer term sustainable capacity building for intellectual property activities - Need to distinguish between hard capabilities (skills, knowledge on intellectual property rights issues) from soft capabilities (awareness, networking, process oriented) in fostering capacity building for intellectual property - Undertake global review of current initiatives and needs assessment evaluation - Support partnership and participation of private sector and civil society - Differentiate capacity building approach according to country's specificities and intellectual property priorities - Improve donors coordination (perhaps through the DAC) - Conduct sustained and consistent capacity building for intellectual property activities within longer-term assistance programmes - Need for donors to commit to untied aid on intellectual property issues	- Focus on short-term capabilities to follow and understand current negotiations (training, seminars, studies), to translate country strategies into negotiation positions and to identify priorities and adjust positions to dynamic negotiation setting - Support developing country coalitions and alliances	- Build on existing capacities and develop current institutions, rather than create many new institutions and initiate reforms that will not be fully completed - Support relevant regional initiatives and activities that help developing country actors generate a policy space and create synergies conducive to the implementation and utilization of opportunities and flexibilities in the international intellectual property regime	- Support reforms of WIPO (development agenda) (and other international organizations): decision-making process to improve member participation, transparency, accountability and ultimately legitimacy of the international intellectual property regime - Increase funding of multilateral and regional capacity building for intellectual property programmes as well as relevant programmes of international organizations - Lead intergovernmental agency to streamline programmes, financing procedures and support mechanisms, to facilitate funding of capacity building for intellectual property activities conducive to reinforcing the legitimacy of the international intellectual property regime

Levels of capacity	National Institutions in Developing Countries			Governance of international institutions
Type of capacity	**Design and strategy development**	**Negotiation**	**Implementation and utilization**	**Required international governance conditions for support**
On operations	- Foster long-term capacity building programmes to support recipient-country university and research and knowledge institutions and non-state actors, including indigenous communities, on intellectual property issues, with mentorship from and partnership with experts from international organizations and academic/research/policy analysis institutions - Support cross-border exchange of officials and internship, including at senior level - Get donors to contribute to international system of data collection on activities - Identify and disseminate good practice	- Finance representation in Geneva of weakest countries to the WTO and provide adequate intellectual property technical assistance to allow their participation in the negotiations - Support resource pooling initiatives by developing countries to improve their participation, notably through WTO coalitions and regional groupings - Create an intellectual property technical assistance programme with a pool of experts available for emerging urgent needs arising from the negotiations, able to respond to ad hoc demands from developing countries	- Make developing countries implementation of international intellectual property commitments conditional to domestic capacity, and notably capacity building for intellectual property and financial support - Complementarity between capacity building for intellectual property and capacity building programmes covering related dimensions (infrastructure, supply-side constraints, institutional development, trade and competition policies) - Provide support to developing countries on the use of the WTO dispute settlement mechanism (support regional centres of expertise, train national officials and experts, establish financing facility)	- Increase budget of technical assistance programme of WIPO - Mandate an intergovernmental organization to lead the global efforts for intellectual property capacity building - Extend current capacity building programmes to more countries, and better integrate national, bilateral and regional intellectual property (and development) dimension to the international intellectual property regime considerations - Facilitate the observer status of regional groupings and provide direct support, as well as to WTO coalitions of developing countries

Notes

1. Available at www.un.org/millenniumgoals.
2. Barton (2006b).
3. Available at www.un.org/millenniumgoals.
4. For the text of the TRIPS agreement, go to www.wto.org/english/docs_e/legal_e/27-trips_08_e.htm.
5. In his study Barton (2006a, p. 14) estimates that "the total donor funding for developing world research and development capacity is roughly 0.3% of the amount of research and development in the developed world—and far less on a per capita basis".
6. See, for instance, Fink and Maskus (2005).
7. WIPO's "Program and Budget 2004–2005", with cooperation with developing countries. Available at www.wipo.int/documents/en/document/govbody/budget/2004_05/pdf/wo_pbc_6_2_program08.pdf.
8. The text of the agreement can be read at www.wto.org/english/tratop_e/trips_e/wtowip_e.htm.
9. One of its technical support activities is indeed to share the information technology products that it has developed with patent offices in developing countries, such as its intranet software application, SOPRANO-CS, or its POLite (Patent Office Lite), a basic application for automating administrative procedures. POLite's pilot site is implemented for ARIPO, for instance.
10. The book can be downloaded from www.unctad.org/en/docs//ditcted10_en.pdf.
11. UNESCO's legal instruments can be found at http://portal.unesco.org/en/ev.php-URL_ID=12024&URL_DO=DO_TOPIC&URL_SECTION=201.html. There are voluntarily adhered to by UNESCO's member sates, which commit themselves to respect those texts and promote the values and ideas they contain.
12. Doha Development Agenda Trade Capacity Building Database, available at http://tcbdb.wto.org/index.asp.
13. USAID Trade Capacity Building Database, available at http://qesdb.cdie.org/tcb/index.html.
14. USAID Trade Capacity Building Database. Detailed country activities related to trade capacity building for the TRIPS agreement can also be found at http://esdb.cdie.org/cgi-bin2/broker.exe?_service=default&_program=tcbprogs.act_cat_2.sas&group=cat&code=011500+&year=2003&output=1.

15. The Diplo Foundation is a non-profit knowledge organization established by the governments of Malta and Switzerland in 2002 and funded by Swiss Development Cooperation Agency. It works to build information technology expertise and enhance the impact of education and research for countries with limited financial and human resources to help them participate meaningfully in international affairs.
16. SPIKE was expected to start in its pilot phase in 2004. Available at www.southcentre.org/spike/spikebrochure.pdf.
17. This does not necessarily mean that international organizations do not have any activities aimed at strengthening the negotiating capacities of developing countries. The WTO and World Bank, for instance, provide assistance for developing countries to help them participate in the multilateral trade negotiations. But technical assistance is not specifically dedicated to intellectual property issues and does not represent a significant component of their intellectual property–related technical assistance activities.
18. The term "flexibilities" with respect to the TRIPS agreement refers to the four "preferential conditions granted to [developing countries] in relation to the protection of their public health, namely: (i) requirement to read TRIPS provisions in light of the object and purpose of the Agreement, particularly its objectives and principles in the application of customary rules, (ii) right to grant and obtain compulsory licences, (iii) the right for each member to determine national emergency situations, and (iv) the right for each member to establish its own regime for exhaustion of intellectual property rights." See WTO (2001a).
19. Financial assistance, for instance, implies investing in research and development in certain sectors of developing economies that hold the key to their development, while technical assistance and capacity building could focus in fostering cooperation and building networks among government agencies, private firms, non-governmental organizations, universities and research institutes—which all play a fundamental role in bringing about innovation and change.
20. See, for instance, WIPO (2004a). The forum asks WIPO and its member states to develop practical toolkits and guidelines, and other best practices guides relating to intellectual property issues so as to strengthen indigenous communities' capacities to "make informed decisions in their own interests" and to provide funding for their participation in WIPO's work on technical knowledge, genetic resources and traditional cultural expressions and folklore and particularly for their

active participation in the WIPO Intergovernmental Committee's sessions and the workshops, consultations and briefings it organizes.

21. It is difficult to find data on the World Bank's expenditures towards intellectual property capacity building. Its lending for trade capacity building has doubled from $132 million (€118 million) in 1998–2000 to $267 million (€239 million) in 2001–03.

22. The actual funds that the WTO dedicates to intellectual property or TRIPS technical assistance are not specified in any of WTO's public documents. Its current budget is CHF 1.36 million (€0.87 million) for technical cooperation and CHF 4.29 million (€2.7 million) for training. If, as the Trade Capacity Building Database suggests, about 0.43% of the total funds for trade capacity building are provided to TRIPS-related technical assistance, then we could roughly estimate that the WTO spends €0.01 million for TRIPS-related technical assistance, including three-quarters of it for training.

23. The database can be accessed at http://tcbdb.wto.org/index.asp. For an explanation of the database, and the problems arising in the interpretation of the data, see Bilal and Szepesi (2006).

24. See note 20.

25. It is notable that WIPO has planned to slightly increase its expenditures on technical assistance for 2004–05 to reach about CHF 95 million (€61 million) out of a total budget of CHF 539 million (€410 million)—that is, by about 15%.

26. Musungu (2003) lists more than 25 major forthcoming events, including reforms and amendments or new implementation of treaties, international conferences, launch or conclusion of negotiations, increase in dispute settlements and the like.

27. What is noted is that despite an increase in funding for technical assistance and the number of providers and programmes, developing and least developed countries have not taken advantage of the flexibilities and policy options available under the TRIPS agreement.

28. The Commission on Intellectual Property Rights reckons that in order to meet the minimum administrative standards required by the TRIPS agreement, a skeleton office handling very low volumes of intellectual property rights applications would be 10 professionals and about 10 administrative and support staff. This requirement expectedly should rise over time with increased volumes of intellectual property rights application.

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