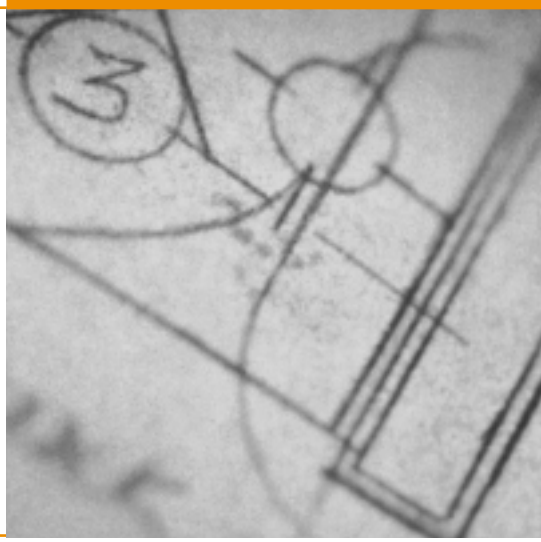
Chapter 1

INTELLECTUAL PROPERTY AND DEVELOPMENT



INTRODUCTION

Intellectual property is a form of knowledge which societies have decided can be assigned specific property rights. They have some resemblance to ownership rights over physical property or land. But knowledge is much more than intellectual property. Knowledge is embodied in people, in institutions and in new technologies in ways that have long been seen as a major engine of economic growth.[1] Alfred Marshall, the "father" of modern economics, thought so in the 19th Century.[2] With recent scientific and technical advances, particularly in biotechnology and information and communications technologies (ICTs), knowledge has become to an even greater degree than before the principal source of competitive advantage for both companies and countries. Trade in high technology goods and services which are knowledge-intensive, and where IP protection is most common, tends to be among the fastest-growing in international trade.[3]

In developed countries, there is good evidence that intellectual property is, and has been, important for the promotion of invention in some industrial sectors, although the evidence as to exactly how important it is in different sectors is mixed. For example, evidence from the 1980s indicates that the pharmaceutical, chemical and petroleum industries were predominant in recognising that the patent system was essential to innovation.[4] Today, one would need to add biotechnology and some components of information technology. Copyright has also proven essential for the music, film and publishing industries.

For developing countries, like the developed countries before them, the development of indigenous technological capacity has proved to be a key determinant of economic growth and poverty reduction. This capacity determines the extent to which these countries can assimilate and apply foreign technology. Many studies have concluded the most distinctive single factor determining the success of technology transfer is the early emergence of an indigenous technological capacity.[5]

But developing countries vary widely in the quality and capacity of their scientific and technical infrastructures. A commonly used indicator of technological capability is the extent of patenting activity in the US and through international applications through the Patent Cooperation Treaty (PCT).[6] In 2001, less than 1% of US patents were granted to applicants from developing countries, nearly 60% of which were from seven of the more technologically advanced developing countries.[7] In the PCT, developing countries accounted for under 2% of applications in 1999-2001, with over 95% of these applications coming from just five countries: China, India, South Africa, Brazil and Mexico.[8] In these countries patent applications, although small, are growing faster than PCT applications generally. PCT applications grew by nearly 23% between 1999 and 2001, but the share of these countries in the total increased from 1% in 1999 to 2.6% in 2001. As we have seen R&D expenditure is heavily concentrated in developed countries, and in a few of the more technologically advanced developing countries. Few developing countries have been able to develop a strong indigenous technological capability. This means that it is difficult either for them to develop their own technology, or to assimilate technology from developed countries.

The crucial question is whether or not the extension of IP regimes assists developing countries in obtaining access to such technologies, and whether and how intellectual property right protection might help developing countries to achieve economic and social development and to reduce poverty. In this chapter we examine:

- The rationale for IP protection
- Its use historically in developed and developing nations
- The available evidence on the impact of IP on developing countries
- The role IP might have in facilitating the transfer of technology to developing countries.

Box 1.1 What are Intellectual Property Rights?

Intellectual property (IP) rights are the rights awarded by society to individuals or organisations principally over creative works: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce. They give the creator the right to prevent others from making unauthorised use of their property for a limited period. IP is categorised as Industrial Property (functional commercial innovations), and Artistic and Literary Property (cultural creations). Current technological developments are blurring, to some extent, this distinction, and some hybrid *sui generis* systems are emerging.

Industrial Property

Patents: A patent is an exclusive right awarded to an inventor to prevent others from making, selling, distributing, importing or using their invention, without license or authorisation, for a fixed period of time (TRIPS stipulates 20 years minimum from filing date). In return, society requires that the patent applicant disclose the invention in a manner that enables others to put it into practice. This increases the body of knowledge available for further research. As well as sufficient disclosure of the invention, there are three requirements (although details differ from country to country) that determine the patentability of an invention: novelty (new characteristics which are not "prior art"),[9] non-obviousness (an inventive step not obvious to one skilled in the field), and utility (as used in the US) or industrial applicability (as used in the UK). Utility models are similar to patents, but in some countries confer rights of shorter duration to certain kinds of small or incremental innovations.

Industrial Designs: Industrial designs protect the aesthetic aspects (shape, texture, pattern, colour) of an object, rather than the technical features. TRIPS requires that an original design be eligible for protection from unauthorised use by others for a minimum of 10 years.

Trademarks: Trademarks provide exclusive rights to use distinctive signs, such as symbols, colours, letters, shapes or names to identify the producer of a product, and protect its associated reputation. In order to be eligible for protection a mark must be distinctive of the proprietor so as to identify the proprietor's goods or services. The main purpose of a trademark is to prevent customers from being misled or deceived. The period of protection varies, but a trademark can be renewed indefinitely. In addition many countries provide protection against unfair competition, sometimes by way of preventing misrepresentations as to trade origin regardless of registration of the trademark.

Geographical Indications: Geographical Indications (GIs) identify the specific geographical origin of a product, and the associated qualities, reputation or other characteristics. They usually consist of the name of the place of origin. For example, food products sometimes have qualities that derive from their place of production and local environmental factors. The geographical indication prevents unauthorized parties from using a protected GI for products not from that region or from misleading the public as to the true origin of the product.

Trade Secrets: Trade secrets consist of commercially valuable information about production methods, business plans, clientele, etc. They are protected as long as they remain secret by laws which prevent acquisition by commercially unfair means and unauthorised disclosure.

Artistic and Literary Property

Copyright: Copyright grants exclusive rights to the creators of original literary, scientific and artistic works. Copyright only prevents copying, not independent derivation. Copyright protection begins, without formalities, with the creation of the work, and lasts (as a general rule) for the life of the creator plus 50 years (70 years in the US and EU). It prevents unauthorised reproduction, public performance, recording, broadcasting, translation, or adaptation, and allows the collection of royalties for authorised use. Computer programs are protected by copyrights, as software source and code have been defined as a literary expression.

***Sui Generis* systems**

Integrated Computer Circuits: A specific *sui generis* form of protection for design of integrated computer circuits. As the inventive step is often minimal and originality is the only requirement, the minimum period of protection under TRIPS is 10 years.

Plant Breeders' Rights: Plant breeders' rights (PBRs) are granted to breeders of new, distinct, uniform and stable plant varieties. They normally offer protection for at least fifteen years (counted from granting). Most countries have exceptions for farmers to save and replant seeds, and for the use of protected materials for further breeding.

Database Protection: The EU has adopted legislation to provide *sui generis* protection in respect of databases, preventing unauthorised use of data compilations, even if non-original. Exclusive rights to extract or utilize all or a substantial part of the contents of the protected database are granted.

THE RATIONALE FOR IP PROTECTION

Introduction

Intellectual property creates a legal means to appropriate knowledge. A characteristic of knowledge is that one person's use does not diminish another's (for example, reading this report). Moreover the extra cost of extending use to another person is often very low or nil (for example, lending a book or copying an electronic file). From the point of view of society, the more people who use knowledge the better because each user gains something from it at low or no cost, and society is in some sense better off. Economists therefore say that knowledge has the character of a *non-rival public good.*[10]

The other aspect of knowledge, or products embodying knowledge, is the difficulty - often intrinsic - of preventing others from using or copying it. Many products, incorporating new knowledge, can be easily copied. Probably most products, with sufficient effort, can be copied at a fraction (albeit not necessarily small) of the cost it took to invent and market them. Economists refer to this latter characteristic as contributing to *market failure.* If a product takes considerable effort, ingenuity and research, but can be copied easily, there is unlikely to be a sufficient financial incentive from society's point of view to devote resources to invention,

Patents

Patents are one way of addressing this market failure. By conferring temporary market exclusivities, patents allow producers to recoup the costs of investment in R&D and reap a profit, in return for making publicly available the knowledge on which the invention is based. However, someone else can only put that knowledge to potential commercial use with the authorisation of the patentee. The costs of investment in R&D and the return on that investment are met by charging the consumer a price based on the ability to exclude competition.

Protection is therefore a bargain struck by society on the premise that, in its absence, there would be insufficient invention and innovation. The assumption is that in the longer run, consumers will be better off, in spite of the higher costs conferred by monopoly pricing, because the short term losses to consumers are more than offset by the value to them of the new inventions created through additional R&D. Economists take the view that the patent system improves dynamic efficiency (by stimulating technical progress) at the cost of static efficiency (arising from the costs associated with monopoly).

This rationale for patent protection is relatively straightforward, but it is dependent on a number of simplifying assumptions that may not be borne out in practice. For instance, the optimal degree of patent protection cannot be accurately defined. If protection is too weak, then the development of technology may be inhibited through insufficient incentives for R&D. If too much protection is conferred, consumers may not benefit, even in the long run, and patentees may generate profits far in excess of the overall costs of R&D. Moreover, further innovation based on the protected technology may be stifled because, for instance, the length of the patent term is too long or the scope of the protection granted is too broad.

The length of the monopoly granted is one determinant of the strength of patent protection. Another is the scope of the patent. A broad patent is one that allows a right that goes considerably beyond the claimed invention itself. For example, a patent which claims a gene might only specify one use of that gene. But, under certain approaches to the scope of protection, the patentee will also have the rights to uses of the genetic information other than those disclosed in the patent, including those discovered later by someone else. Broad patents can tend to discourage subsequent innovation by other researchers in the general area of the patent. In contrast, narrow claims will encourage others to 'work around' the patent, offering less restriction on related research by others. They may also tend to create stronger rights which are less vulnerable to challenge in the courts.[11] The licensing policy pursued by the patentee will also have an important effect on the dissemination of new technologies, and the extent to which further research is affected by the granted rights.

The optimal degree of protection (where the social benefits are judged to exceed the social costs) will also vary widely by product and sector and will be linked to variations in demand, market structures, R&D costs and the nature of the innovative process. In practice IPR regimes cannot be tailored so precisely and therefore the level of protection afforded in practice is necessarily a compromise. Striking the wrong compromise - whether too much or too little - may be costly to society, especially in the longer term.

One underlying assumption is that there is a latent supply of innovative capacity in the private sector waiting to be unleashed by the grant of the protection that the IP system provides. That may be so in countries where there is substantial research capacity. But in most developing countries local innovation systems (at least of the kind established in developed countries) are weak. Even where such systems are stronger, there is often more capacity in the public than the private sectors.[12] Thus, in such contexts, the dynamic benefit from IP protection is uncertain. The patent system may provide an incentive but there may be limited local capacity to make use of it. Even when technologies are developed, firms in developing countries can seldom bear the costs of acquisition and maintenance of rights and, above all, of litigation if disputes arise.

Economists are also now very aware of what they call *transactions costs.* Establishing the infrastructure of an IPR regime, and mechanisms for the enforcement of IP rights, is costly both to governments, and private stakeholders. In developing countries, where human and financial resources are scarce, and legal systems not well developed, the opportunity costs of operating the system effectively are high. Those costs include the costs of scrutinising the validity of claims to patent rights (both at the application stage and in the courts) and adjudicating upon actions for infringement. Considerable costs are generated by the inherent uncertainties of litigation. These costs too need to be weighed against the benefits arising from the IP system.

Thus the value of the patent system needs to be assessed in a balanced way, acknowledging that it has both costs and benefits, and that the balance of costs and benefits is likely to differ markedly in diverse circumstances.

Amongst academics, notably economists, IPRs have generally been viewed critically. Such rights necessarily involve restrictions on competition which may be to the detriment of consumers and the freedom of trade, and the question is whether these costs are outweighed by the incentives for research and invention. The quotations in Box 1.2 below reflect well the ambivalence that is widely expressed about the effects of the IP system in developed countries, and its impact on developing countries. This ambivalence has tended to strengthen as the IP system has embraced new technologies.

Box 1.2 Conclusions on the Value of the IP System

Edith Penrose in "The Economics of the International Patent System" in 1951:

"Any country must lose if it grants monopoly privileges in the domestic market which neither improve nor cheapen the goods available, develop its own productive capacity nor obtain for its producers at least equivalent privileges in other markets. No amount of talk about the "economic unity of the world" can hide the fact that some countries with little export trade in industrial goods and few, if any, inventions for sale have nothing to gain from granting patents on inventions worked and patented abroad except the avoidance of unpleasant foreign retaliation in other directions. In this category are agricultural countries and countries striving to industrialise but exporting primarily raw materials…whatever advantages may exist for these countries…they do not include advantages related to their own economic gain from granting or obtaining patents on invention."[13]

Fritz Machlup concluded after studying the US patent system in 1958:

"If one does not know whether a system…is good or bad, the safest "policy conclusion" is to muddle through – either with it, if one has long lived with it, or without it, if one has lived without it. If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it. This last statement refers to a country such as the U.S. – not to a small country and not a predominantly non-industrial country, where a different weight of argument might well suggest another conclusion."[14]

And another leading economist, Lester Thurow, wrote in 1997:

"In a global economy, a global system of intellectual property rights is needed. This system must reflect the needs both of countries that are developing and those that have developed. The problem is similar to the one concerning which types of knowledge should be in the public domain in the developed world. But the Third World's need to get low cost pharmaceuticals is not equivalent to its need for low cost CDs. Any system that treats such needs equally, as our current system does, is neither a good nor a viable system."[15]

A prominent academic lawyer, Larry Lessig, said of the US in 1999:

"No doubt we are better off with a patent system than without one. Lots of research and invention wouldn't occur without the government's protection. But just because some protection is good, more isn't necessarily better…There is growing skepticism among academics about whether such state-imposed monopolies help a rapidly evolving market such as the Internet…The question economists are now asking is whether expanded patent protection will do any good. Certainly it will make some people very rich, but that's different from improving a market…Rather than unbounded protection, our tradition teaches balance and the dangers inherent in overly strong intellectual property regimes. But balance in IP seems over for now. A feeding frenzy has taken its place - not just in the field of patents, but in IP generally…"[16]

And Jeffrey Sachs, an eminent economist, said in 2002:

"…there is an opportunity to re-think the intellectual property rights regime of the world trading system vis-à-vis the world's poorest countries. In the Uruguay Round negotiation, the international pharmaceutical industry pushed very hard for a universal coverage of patent protection without considering the implications for the poorest countries. There is little doubt that the new IPR arrangements can make it more difficult for consumers in the poorest countries to access key technologies, as we've seen vividly in the case of essential medicines. The countries negotiating the new Doha round have already committed to re-examining the IPR issue in light of public health priorities, and they are wise to do so. It also may well be the case that the tightening of IPRs may slow the diffusion of technology to the world's poorest countries that has traditionally come through copying and reverse engineering. Those hallowed pathways of technological diffusion are increasingly being slowed, and the effects on the poorest countries may be unduly hindered. This is an area for close observation, policy attention, and continuing research."[17]

Copyright

The rationale for copyright protection is not dissimilar to that of patents, although historically greater weight has been given to the inherent rights of creative artists to receive fair remuneration for their works than to the incentive effects. Copyright protects the form in which ideas are expressed, not the ideas themselves. Copyright was and remains the basis for making the publishing of literary and artistic works an economic proposition by preventing copying. Unlike patents, copyright protection does not require registration or other formalities (although this was not always the case).

As with patents, the trade-off for society is between the incentive offered to creators of literary and artistic works and the restrictions this places on the free flow of protected works. But, unlike patents, copyright in principle protects the expression of ideas, and not the ideas as such, which may be used by others. And it only prevents the copying of that expression, not independent derivation. The central issue for developing countries concerns the cost of access to physical or digital embodiments of the protected works, and the approach taken to enforcement of copyright protection.

As with patents, there are normally exceptions in law where the rights of owners are moderated in the wider public interest, known in some countries as "fair use" provisions (for example in the US), as "fair dealing" in the UK tradition, and exceptions to the reproduction right in the European tradition.[18] It is the issue concerning the cost of access, and the interpretation of "fair use", that is particularly critical for developing countries, made more so by the extension of copyright to electronic material, and to software.

Copyright protects works for much longer than patents but does not protect against independent derivation of the work in question. Under TRIPS copyright allows a minimum of fifty years after the death of the author, but most developed countries and several developing countries have increased this to 70 years or more. While the main reason for the extension of copyright has been pressure from the copyright industries (notably the film industry in the US), there is no clear economic rationale for copyright protection being so much longer than that for patents. Indeed, the rate of technical change has led in several industries to a shorter effective product life (for example, successive editions of software programmes) which point to longer copyright protection being redundant. The successive increases in the period of copyright protection have given rise to concern in some quarters. This year the US Supreme Court is hearing a case that challenges the 1998 Copyright Term Extension Act on the grounds that it violates the Constitution which specifies that protection must be for "limited Times". In addition, it is asserted that an extension of protection granted for a work that already exists can have no incentive effect, and also violates the *quid pro quo* requirement in the Constitution that monopoly rights are provided in exchange for public benefits.[19]

As with patents, a key issue for developing countries is whether the gains to be elicited from the incentives provided by copyright outweigh the increased costs associated with the restrictions on use that flow from copyright. Although there are exceptions, such as India's film or software industry, most developing countries are net importers of copyrighted material, just as they are net importers of technologies. Since copyright does not need registration or other formalities, once a country has copyright laws in place, the impact of copyright is more ubiquitous than in the case of patents. Software, textbooks, and academic journals are key items where copyright is a determining factor in pricing and access, and which are also essential ingredients in education and other spheres crucial to the development process. For instance, a reasonable selection of academic journals is far beyond the purchasing budgets of university libraries in most developing countries, and increasingly in developed countries as well.

The interaction of the Internet and copyright is an issue of particular and growing importance for developing countries. With printed media, there are provisions for "fair use" under copyright law, and the nature of the medium lends itself to multiple use either formally through libraries or

informally through borrowing and browsing (as may be done in a bookshop before deciding to purchase). With material accessed through the Internet, the technology allows encryption and other means to exclude potential users even from browsing, unless they have paid the relevant charge. While the "philosophy" of the Internet has hitherto been about free access, increasingly sites with material of value are moving towards charging for use, or limiting access in other ways. Further, the DMCA in the US and Europe's Database Directive have provisions that go well beyond what is required under TRIPS, and are held by many users to have shifted the balance of protection too far in favour of investors and originators of collections of data.

Thus, as with patents, there is a need for balance. Too much protection by copyright, by other forms of IP protection, or by technology, may restrict the free flow of ideas on which the further progress of ideas and technology depends. For developing countries, affordable access to works essential for development such as educational materials and scientific and technical knowledge may be affected by unduly strong copyright rules.

HISTORY

There are several lessons that we can learn from history, particularly from the experience of the developed countries in the 19th century, and the emerging economies of East Asia in the last century.

First, historically IP regimes have been used by countries to further what they perceive as their own economic interests. Countries have changed their regimes at different stages of economic development as that perception (and their economic status) has changed. For instance between 1790 and 1836, as a net importer of technology, the US restricted the issue of patents to its own citizens and residents. Even in 1836, patents fees for foreigners were fixed at ten times the rate for US citizens (and two thirds as much again if one was British!). Only in 1861 were foreigners treated on an (almost wholly) non-discriminatory basis. In his Annual Report for 1858, the US Commissioner of Patents noted:

> "It is a fact, as significant as it is deplorable, that of the 10,359 inventions shown to have been made abroad during the last twelve months, but forty-two have been patented in the US. The exorbitant fees exacted of the foreigner, and the severity of the offensive discrimination established to his prejudice, afford a sufficient explanation of the result…it might well be concluded that the government of this country regarded an invention made beyond the seas as something intrinsically dangerous, if not noxious, the introduction of which it is morally just and politically wise to burden with taxation, just as you would thus burden the importation of some foreign poisonous drug. There is a loftier view of this question, and one deemed more in harmony with the progressive spirit of the age -- a view which hails the fruits of the inventive genius, in whatever clime matured, as the common property of the world, and gives them cordial welcome as the common blessings of the race to whose amelioration they are devoted."[20]

Until 1891, US copyright protection was restricted to US citizens but various restrictions on foreign copyrights remained in force (for example, printing had to be on US typesets) which delayed US entry to the Berne Copyright Convention until as late as 1989, over 100 years after the UK. It is for this reason that some readers may remember purchasing books which had on the cover the words: *"For copyright reasons this edition is not for sale in the U.S.A."*

Until the adoption of the Paris Convention (on protecting industrial property) in 1883, and its 1886 Berne counterpart (on literary and artistic works) countries' ability to tailor the nature of their regimes to their own circumstances was unconstrained. Even then, the rules of these Conventions exhibited considerable flexibility. The Paris Convention allowed countries to exclude fields of technology from protection and to determine the length of protection afforded under patents. It also permitted revocation of patents, and compulsory licences[21] to remedy abuses.

Secondly, numerous countries have at times exempted various kinds of invention in certain sectors of industry from patent protection. Often the law has restricted patents on products confining protection to processes for their production. Typically these sectors have been foodstuffs, pharmaceuticals and chemicals, based on the judgement that no monopoly should be granted over essential goods, and that there is more to be gained by encouraging free access to foreign technology, than by potentially stimulating invention in domestic industry. This approach was adopted by many countries which are now developed in the 19th Century, and for some until late in the 20th Century, and also in the East Asian countries (such as Taiwan and Korea) until relatively recently. However, TRIPS now forbids discrimination in the grant of patent protection in respect of different fields of technology.

Thirdly, intellectual property, and patents in particular, have often been politically contentious. Between 1850 and 1875, a debate raged in Europe, both in academic and political circles, on whether the patent system was a blight on free trade principles or the best practical means of stimulating inventions. John Stuart Mill took the latter view:

> "…an exclusive privilege, of temporary duration is preferable [as a means of stimulating invention]; because it leaves nothing to anyone's discretion; because the reward conferred by it depends upon the invention's being found useful, and the greater the usefulness, the greater the reward; and because it is paid by the very persons to whom the service is rendered, the consumers of the commodity."

In essence, this remains the case for the system today – a relatively inexpensive way (at least for governments, in so far as they are not purchasers of the goods) to provide an incentive for invention with a reward proportionate to the use subsequently made of it.[23]

Opposition to patent protection was advanced on various grounds but was summed up in the words of the Economist in 1851:

> "The privileges granted to inventors by patent laws are prohibitions on other men, and the history of inventions accordingly teems with accounts of trifling improvements patented, that have put a stop, for a long period, to other similar and much greater improvements…The privileges have stifled more inventions than they have promoted…Every patent is a prohibition against improvements in a particular direction, except by the patentee, for a certain number of years; and, however, beneficial that may be to him who receives the privilege, the community cannot be benefited by it…On all inventors it is essentially a prohibition to exercise their faculties; and in proportion as they are more numerous than one, it is an impediment to the general advancement…"[24]

Again, this clearly illustrates a theme that recurs in current discussions. If the system protects one set of inventions, can it avoid deterring those who seek to make improvements upon the first?

Foreshadowing the debates concerning TRIPS, the 19th Century argument was also related to the free trade controversy in that the patent system, by conferring monopolies, was seen by some as a contravention of free trade principles. Moreover there was self-interest at work. In Switzerland in the 1880s, industrialists did not want a patent law because they wished to continue to use the inventions of foreign competitors. This opposition was maintained in spite of the fact that the Swiss were enthusiastic patentees in other countries themselves. And because Switzerland had low tariffs, they feared that those competitors would take out patents in Switzerland and then drive out Swiss competition under their protection.

Switzerland did eventually adopt a patent law, with various exclusions and safeguards, not because most Swiss thought there was any net benefit to be had from allowing foreign patents, but because Switzerland came under intense pressure, particularly from Germany, to do so and did not wish to invite retaliation from other countries.[25] Safeguards adopted included provisions for compulsory working[26] and compulsory licensing which enabled the government to enforce production in

Switzerland by one means or another, if it so desired. In addition, chemicals and textile dyeing were excluded from patent protection. Elsewhere in Europe the proponents of the patent system also largely won the argument, just as the free trade movement waned in the face of the Great Depression in Europe. Only in Holland did the movement against patents wholly succeed, and from 1869 until 1912 no patents were issued there.[27]

Fourthly, the best examples in the recent history of development are the countries in East Asia which used weak forms of IP protection tailored to their particular circumstances at that stage of their development. Throughout the critical phase of rapid growth in Taiwan and Korea between 1960 and 1980, during which their economies were transformed, both countries emphasised the importance of imitation and reverse engineering[28] as an important element in developing their indigenous technological and innovative capacity. Korea adopted patent legislation in 1961, but the scope of patenting excluded foodstuffs, chemicals and pharmaceuticals. The patent term was only 12 years. It was only in the mid-1980s, particularly as a result of action by the US under Section 301 of its 1974 Trade Act, that patent laws were revised, although they did not yet reach the standards to be set under TRIPS. A similar process took place in Taiwan. In India, the weakening of IP protection in pharmaceuticals in its 1970 Patent Act[29] is widely considered to have been an important factor in the subsequent rapid growth of its pharmaceutical industry, as a producer and exporter of low cost generic medicines[30] and bulk intermediates.[31]

The general lesson history shows us is that countries have been able to adapt IPR regimes to facilitate technological learning and promote their own industrial policy objectives. Because policies in one country impinge on the interests of others, there has always been an international dimension to debates on IP. The Paris and Berne Conventions recognised this dimension, and the desirability of reciprocity, but allowed considerable flexibility in the design of IP regimes. With the advent of TRIPS, a large part of this flexibility has been removed. Countries can no longer follow the path adopted by Switzerland, Korea or Taiwan in their own development. The process of technological learning, and of progressing from imitation and reverse engineering to establishing a genuine indigenous innovative capacity, must now be done differently from in the past.

THE EVIDENCE ABOUT THE IMPACT OF IP

The Context

Analysis of the available evidence on the impact of IPR regimes on developing, or developed countries, is a complex task. As noted above, we do not wish to focus on IPRs as an end in themselves, but on how they can contribute to development and the reduction of poverty. We believe that a prerequisite for sustainable development in any country is the development of an indigenous scientific and technological capacity. This is necessary to allow countries to develop their own process of technological innovation, and to enable them to absorb effectively technologies developed abroad. It is obvious that the development of such capacity is dependent on a large number of elements. It requires an effective education system, particularly at the tertiary level, and a network of supporting institutions and legal structures. It also requires the availability of financial resources, both public and private, to pursue technological development. There are many other factors that contribute to what are often known as "national systems of innovation".

Viewed this way, the issue is whether IPRs can contribute to promoting effective national systems of innovation *in principle* and, given the wide existing variations in the indigenous scientific and technological capacity, how they can do so effectively *in practice,* taking account of the circumstances in particular countries. Moreover, since we are not just interested in the dynamic effect of IPRs in promoting innovation, but also the costs that IP protection imposes on society, particularly on poor people, we need to take account of these costs in considering the evidence and the value of any given IP system.

Much of the evidence about IPRs is either indirect or based on proxy measures. We cannot measure directly a country's capacity for innovation (for example, we might commonly use R&D expenditures or innovations-related expenditures as a proxy). Nor can we directly measure the strength of patent protection in a country (although indices have been compiled using a mixture of proxies). The use of econometrics, which attempts to isolate the independent effect of IPRs on economic variables, is often contested, particularly as to whether it demonstrates association rather than causation. For instance, some authorities argue that the absence of IP protection encourages technology transfer and technological learning (through copying and imitation). Others argue that IP protection is a mechanism which encourages technology transfer from abroad through direct investment or licensing, and the indirect effects are an effective means of technological learning. Determining where the truth lies can be difficult for policymakers.

Redistributive Impact

Developing countries, taken as a whole, are net importers of technology, most of which is supplied by the developed countries. Organisations in developed countries own the overwhelming proportion of patent rights worldwide. Econometric models have been constructed to estimate what would be the global impact of applying the TRIPS agreement (i.e. globalising minimum standards for IP protection). The latest estimate, by the World Bank, suggests that most developed countries would be the major beneficiaries of TRIPS in terms of the enhanced value of their patents, with the benefit to the US estimated at an annual $19 billion. Developing countries, and a few developed ones, would be the net losers. The country sustaining the largest loss in the study by the World Bank was Korea ($15 billion). Not too much should be read into the exact value of these figures, which depend on a number of debateable assumptions, but it can safely be said that the effect of applying patent rights globally will be to benefit very considerably the holders of patent rights, mainly in developed countries, at the expense of the users of protected technologies and goods in developing countries. Between 1991 and 2001, the net US surplus of royalties and fees (which mainly relate to IP transactions) increased from $14 billion to over $22 billion.[33] In 1999, figures from the World Bank indicate a deficit for developing countries for which figures are available of $7.5 billion on royalties and licence fees.[34]

Growth and Innovation

That the extension of IPRs would tend to benefit the developed countries is not surprising and explains why pressure was applied by industry in developed countries for the adoption of TRIPS. But the calculations above only consider the cost side of the IPR equation for developing countries. If IPRs are to benefit developing countries that benefit will need to come through promoting invention and technological innovation, and thereby enhancing growth.

At the country level, there appears to be little economic research on developing countries that directly links the IPR regime to domestic innovation and development. An approach common to Germany, and the East Asian countries (including China), was the introduction of easily obtained utility models (or petty patents), which combined a lower standard of inventiveness, with registration rather than examination, and a shorter protection period.[35] When introduced in Germany, in 1891, these provided for three years of protection (renewable for a further three years) and by the 1930s, twice as many utility patents as examined patents were granted.[36] Studies of Japan's patent system in the period 1960-1993 have suggested that utility models were more important than patents in stimulating productivity growth.[37] There is also some evidence relating innovation in particular sectors in Brazil and the Philippines to the availability of such utility models.[38] In Japan, the evidence suggests that a system of "weak" protection based on utility models and industrial designs facilitated incremental innovation by small enterprises, and the absorption and diffusion of technology. This was associated, as in Taiwan and Korea, with an absence of patent protection for chemical and pharmaceutical products. Japan introduced protection for the latter only in 1976.[39]

There is more evidence about the impact of patent protection in developed countries. It appears to indicate that large firms consider patent protection of considerable importance in particular sectors (for example pharmaceuticals) but that in many sectors they are not considered important determinants of innovation.[40] Moreover, patents seem to be hardly used by small and medium enterprises in most sectors in many developed countries, as a means of promoting their innovation, or as a source of useful technical information. An important exception is the biopharmaceutical sector where companies often view their patent portfolios as their most important business asset.[41] A recent large study in the UK concluded that "formal IP regimes are applicable only to a small proportion of business activity, such as large manufacturing companies." Other informal methods of protection, and of obtaining technical information, were generally more effective for SMEs.[42]

The crucial question from our point of view is to what extent IPRs promote growth. The evidence we have reviewed does not suggest strong direct effects on economic growth in developing countries.[43] One recent study found that the more open (to trade) an economy, the more likely it was that patent rights would affect growth. According to this calculation in an open economy, stronger patent rights might increase growth rates by 0.66% per annum.[44] But there is some debate about causation because both openness to trade and the strength of the IPR regime tend to increase in any case with per capita income.

Other evidence suggests that the strength of patent protection increases with economic development, but that this does not occur until quite high levels of per capita income. Indeed, prior to the recent global strengthening of IP laws, there was a reasonably consistent observed relationship between the strength of IP rights and per capita income. At low levels of income, protection is quite high (reflecting past colonial influences) but then falls to a low point of weak protection at an income of about $2000 (at 1985 prices) per capita. This low point is maintained until a per capita income of nearly $8000 when the strength of protection begins to increase again. This association is not necessarily causal but it does indicate that until relatively high levels of per capita income, IPR protection is not a high priority in developing country policy.[45]

Maybe the simplest evidence of the impact of the IP system is how much it is used, particularly by nationals. The propensity to take out patents will reflect some judgement as to the benefits, albeit private rather than social benefits. In sub-Saharan Africa in 1998 (excluding South Africa), 35 patents were granted to residents compared to 741 for non-residents. By contrast in Korea, 35900 patents were issued to residents, compared to 16990 to non-residents. In the US, the corresponding figures were 80292 and 67228.[46]

The main conclusion seems to be that for those developing countries that have acquired significant technological and innovative capabilities, there has generally been an association with "weak" rather than "strong" forms of IP protection in the formative period of their economic development. We conclude therefore that in most low income countries, with a weak scientific and technological infrastructure, IP protection at the levels mandated by TRIPS is not a significant determinant of growth. On the contrary, rapid growth is more often associated with weaker IP protection. In technologically advanced developing countries, there is some evidence that IP protection becomes important at a stage of development, but that stage is not until a country is well into the category of upper middle income developing countries.[47]

Trade and Investment

Although the direct impact on growth is difficult to discern, much effort has been devoted to establishing the impact of changing IPR rights on trade and foreign investment. We do not find some of this work very helpful to our study. Much of it does not address the impact of IP rights on developing countries, but focuses instead on the question of how developed country exports and investment may be affected by strengthening IP rights in developing countries. These two approaches are not the same.

For instance, some studies show that stronger patent rights in developing countries would significantly increase imports from developed countries (or indeed other developing countries).[48] The argument is that some imports are a form of technology transfer (for example, high technology machinery imports have an independent impact on productivity). But strengthening IPRs is also particularly effective in increasing imports of low technology consumer items and is associated with the decline of indigenous industries based on imitation.[49] This effect is clearly a mixed blessing for a developing country. It may be that there is access to more high technology imports previously withheld for lack of IP protection but the costs may be very substantial in terms of lost output and employment, or even retarded growth. This issue is now a very real one in countries such as China. These studies also imply that countries with little technological capacity may experience reduced imports because the patent laws have the effect of increasing import prices on average, and hence reduce import capacity. Countries in the past have protected themselves against the possible adverse effects of increased imports on domestic industry through provisions relating to compulsory working of patents, as Switzerland did in the 19th century.

As regards the analyses of the impact on foreign investment, we have similar reservations. There is a considerable literature which discusses the extent to which stronger IPRs influence foreign investment, licensing behaviour and the transfer of technology. Much of this literature reaches only tentative conclusions, because of weaknesses in data or methodology.[50] Many of the studies pose the question, partly for reasons of data availability, in terms of how strengthening patents rights in developing countries will affect the investment, production and licensing behaviour of US multinationals in developing countries. For instance, one of the conclusions reached in a recent study, but it is typical of others working with similar datasets, is as follows:

> "…these results suggest that if an average developing country were to strengthen its patent index by one unit, local sales of US affiliates would rise by…about 2% of average annual sales…a one-unit increase in the patent index of the average developing economy would raise the asset stock of US multinational affiliates by…about 16% of average asset stock."[51]

For policymakers in a developing country, the framework and questions might be rather different. He or she would want to know, if IPRs were strengthened, whether that would be likely to affect economic growth, employment, investment and R&D in the private sector, access to foreign technology, the domestic innovation process, and exports (as well as imports). There is a paucity of studies that directly address these issues of critical importance to policymakers in developing countries, let alone reach definitive conclusions on the impact of IPRs.

What is clear from the literature is that strong IP rights alone provide neither the necessary nor sufficient incentives for firms to invest in particular countries. If this was the case, then large countries with high growth rates but weak IPR regimes would not have received large foreign investment inflows in the past and even now. This includes many of the East Asian and Latin American economies which have received the bulk of such flows.[52] If the question is addressed in terms of what factors are most important in determining foreign investment, it is quite common for IPRs to be omitted altogether. For instance, recent reports from international institutions and bodies on investment flows almost entirely fail to mention IPRs as a factor. These include, for instance, the World Bank's report on Global Development Finance 2002,[53]and the Zedillo report on Financing for Development.[54] Similarly, a recent draft World Bank report on improving India's investment climate makes no mention at all of the role of IPRs.[55]

As we have noted, there is some evidence that for particular industries (such as chemicals) and for particular activities (such as R&D) IPRs may be a significant factor in the decision by firms to invest.[56] But the investment decision is contingent on many factors. For most low technology industries, of the kind that less technologically advanced developing countries are likely to attract, IPRs are unlikely to be a relevant factor in the investment decision. Where technologies are more

sophisticated, but relatively easy to copy, then IPRs may be – though not necessarily - a significant factor in investment decisions if a country has both the scientific capacity to copy and a sufficiently large market to justify the costs of patenting and enforcement and other relevant factors are favourable. In other cases, however, the introduction of IP protection has been associated, as noted above, with an increase in imports, rather than investment in local production. Finally, in high technology industries and for countries with sophisticated technological capabilities, technology owners may opt to license their technologies, protected by the IP regime, rather than invest directly in production. Thus strong rights may deter investment flows but facilitate technology transfer under licensing, which we return to in the next section.

We conclude from the existing studies the following:

- There is some evidence that trade flows into developing countries are influenced by the strength of IP protection, particularly for those industries (often high technology) that are "IPR sensitive" (for example, chemicals and pharmaceuticals), but the evidence is far from clear.
- These flows may contribute to productive capability. But they may also be at the expense of domestic output and employment in local "copying" and other industries. Developing countries with no or weak technological infrastructure, may be adversely affected by the higher prices of importing IP protected goods.
- The evidence that foreign investment is positively associated with IP protection in most developing countries is lacking.
- For more technologically advanced developing countries, IPRs may be important to facilitate access to protected high technologies, by foreign investment or by licensing.
- Achieving the right balance may be difficult for some countries such as India or China where some industries have the potential to benefit from IP protection, but the associated costs for industries that were established under weak IP regimes as well as consumers are potentially high.
- Most of the evidence concerning the role of IP in trade and investment relates to those developing countries which are more technologically advanced. For other developing countries, we conclude that any beneficial trade and investment effects are unlikely to outweigh the costs at least in the short and medium term.

TECHNOLOGY TRANSFER

In a sense, the crucial issue in respect of IP is not whether it promotes trade or foreign investment, but how it helps or hinders developing countries to gain access to technologies that are required for their development. If a supplier of foreign technology licenses production to a domestic firm, rather than itself establishing manufacturing locally, less foreign investment will have been attracted. However, the overall result may be more beneficial to the domestic economy because of the indirect contribution to domestic technological capabilities. If high technology imports increase as a result of strengthening IP regimes, a transfer of technology may be achieved (for example, as embodied in capital goods), but there is no guarantee that the domestic economy will be capable of absorbing that technology as a basis for further innovation. Therefore the transfer of technology may not be sustainable. Rather, as we have seen, some countries may use weak IP regimes as a means of gaining access to foreign technologies and developing them using reverse engineering, thereby enhancing indigenous technological capacity. The implementation of TRIPS now restricts the ability of developing countries to follow this path.

But the determinants of effective technology transfer are many and various. The ability of countries to absorb knowledge from elsewhere and then make use and adapt it for their own purposes is also of crucial importance. This is a characteristic that depends on the development of local capacity through education, through R&D, and the development of appropriate institutions without which even technology transfer on the most advantageous terms is unlikely to succeed. The effective

transfer of technology also often requires the transfer of "tacit" knowledge, which cannot be easily codified (for example, as in patent disclosures or instruction manuals). This is why even the best-designed programmes to foster national capacity for research which are funded by donors have not always been successful. Since many technologies of interest to developing countries are produced by organisations from developed countries, the acquisition of technology requires the ability to negotiate effectively based on an understanding of the particular area of technology. This process requires a determined approach on the part of the recipient of technology to acquire the necessary human capital and the appropriate institutions. Countries such as Korea started at a low level of technological expertise forty years ago, comparable to many low income countries today, but have now become innovators in their own right.

This aspect of the process of technology transfer is largely in the hands of developing countries themselves. But this does not mean that developed countries, or international policies more generally, cannot facilitate or hinder the process. The TRIPS agreement recognises in Article 7 that IPRs should contribute to the "transfer and dissemination of technology" but also, in Article 8, that measures may need to be taken to prevent the abuse of IPRs including practices that "adversely affect the international transfer of technology." Article 40 includes provisions to prevent anti-competitive practices in contractual licenses. And Article 66.2 obliges developed countries to provide incentives to their enterprises and institutions to promote technology transfer to least developed countries (LDCs) in order to "enable them to create a sound and viable economic base". These provisions in TRIPS reflect some of the provisions in the draft International Code of Conduct on Technology Transfer, on which negotiations between developed and developing countries failed in the 1980s.[57]

Since then, the global economy has changed. Notably, economic policies around the world have shifted from import substitution and directed industrialisation behind high tariff barriers towards open market policies which emphasise the benefits to be gained through low tariffs, global competition and a less directive role for governments in economic development. The so-called knowledge-based industries, and trade in high technology products, have grown apace. The importance of R&D has increased and product life cycles have shortened. In this liberalised and competitive environment, firms in developing countries can no longer compete on the basis of importing "mature" technologies from developed countries and producing them behind tariff barriers. Firms are more wary of transferring technology in ways that may increase the competition they face.

Thus the problem is not so much now about obtaining more or less mature technologies on fair and balanced terms, but of accessing the sophisticated technologies that are required to be competitive in today's global economy. TRIPS has strengthened the global protection offered to suppliers of technology, but there is no international framework to ensure that the transfer of technology takes place within a competitive framework which minimises the restrictive technology licensing practices with which the Code was concerned.

We are uncertain as to how this gap in the international framework could best be filled. Recommencing discussions on a Code of Conduct is not a viable option in the changed environment. But we do think encouraging and assisting them to build their own competition law regimes could better serve the interests of developing countries. The development of a framework for international competition policy has been discussed for some time in the WTO. We understand the reluctance of developing countries to embark down this path, but the development of national competition laws and effective international cooperation could act as a counterbalance to the aspects of the TRIPS agreement which have the effect of restricting competition globally, and inhibiting technology transfer in certain circumstances.

As regards TRIPS, the evidence suggests that the provisions in Article 66.2 have been ineffective. Developed countries do not appear to have taken additional measures to encourage technology transfer by their firms and institutions. Moreover, the fact that the article applies only to LDCs seems unduly restrictive. As noted above, these are likely to be countries for the most part with the least absorptive capacity. We do not therefore consider that Article 66.2 is the most appropriate way to address the entire issue of technology transfer to developing countries. Moreover some of the IPR provisions used historically to facilitate technology transfer, such as the use of compulsory working, have been significantly diluted under TRIPS. Since technology is mostly in private hands and TRIPS is principally concerned with the protection of IPRs, rather than technology transfer, we are unsure as to whether TRIPS, rather than the WTO more generally, is the right focus for a discussion on technology transfer.

We therefore welcome the establishment of the Working Group on Trade and Technology Transfer which will report to the WTO Ministerial Conference next year.[58] We suggest this includes consideration of whether the TRIPS agreement could be made to work better as one mechanism to promote technology transfer, and what measures might be desirable to ensure that the IPR system promotes, and does not hinder, technology transfer. However, we see the range of complementary measures that will be required to promote technology transfer as equally important.

Although most applied technology is privately owned, it is important to remember the extent to which public spending on basic and applied research supports the process of technological development. Developed country public research spending now often has the explicit objective of enhancing international competitiveness and increasingly, the results of such research may be patented, as we discuss in Chapter 6. Not only is research funding often tied to nationals, perhaps understandably, but also the benefits of such research may be restricted to nationals. For instance the law in the US restricts for the most part the licensing of publicly financed technologies to nationals, a policy for which the scientific and economic logic is less clear.[59]

Much of the technology transfer agenda goes well beyond our brief but we think the following measures need to be seriously considered:

- **Appropriate incentive policies in developed countries to promote technology transfer, for instance tax breaks for companies that license technology to developing countries.**
- **Establishment of effective competition policies in developing countries.**
- **Making more public funds available to promote indigenous scientific and technological capability in developing countries through scientific and technological cooperation. For instance, supporting the proposed Global Research Alliance[60] between developing and developed country research institutions.**
- **Commitments to ensure that the benefits of publicly funded research are available to all.**
- **Commitments to ensure open access to scientific databases.**

[1] The exact role of knowledge and technical change has been a matter of debate amongst economists, but this is the dominant view. For a non-technical discussion of the debate see World Bank (1999) *"World Development Report 1998/99: Knowledge for Development"*, World Bank, Washington DC, pp.18-22. Source: http://www.worldbank.org/wdr/wdr98/

[2] World Bank (1999), p.20.

[3] Maskus, K. (2000a) *"Intellectual Property Rights in the Global Economy"*, Institute for International Economics, Washington DC, pp.73-79.

[4] Mansfield, E. (1986) *"Patents and Innovation"*, Management Science, vol. 32:2, pp.173-81.

[5] Radovesic, S. (1999) *"International Technology Transfer and Catch-up in Economic Development"*, Elgar, Cheltenham, p.242. Also Saggi, K. (2000) "Trade, Foreign Direct Investment and International Technology Transfer: A Survey", World Bank, Washington DC Source: http://www1.worldbank.org/wbiep/trade/papers_2000/saggiTT-fin.pdf), and Rosenberg, N. (1982)

"Inside the Black Box; Technology and Economics", Cambridge University Press, Cambridge.

[6] See Glossary for explanation of the PCT.

[7] Those developing countries which were granted over 50 US patents in 2001 included: China 266, India 179, South Africa 137, Brazil 125, Mexico 87, Argentina 58, Malaysia 56. China (Taiwan) received 6545 and Korea 3763 but these are not developing countries on the World Bank classification. Our count is that 1560 US patents were granted to developing countries on the World Bank list, out of total grants of 184057 in 2001. Source: http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_all.pdf

[8] Information provided to us by WIPO. 4816 applications in 1999-2001 were from these five countries out of total developing country applications of 5014. Total applications were 268918 in 1999-2001. Korea (4622) and Singapore (640) were also major applicants.

[9] See Glossary for definition.

[10] Stiglitz, J. "Knowledge as a Global Public Good", in Kaul, I. Grunberg, I. & Stern, M. (eds) (1999) *"Global Public Goods in the 20th Century: International Cooperation in the 20th Century"*, Oxford University Press, Oxford.

[11] We discuss these issues at greater length in Chapter 6.

[12] The experience of the "emerging" economies such as Korea is that initially the public sector takes the lead but then, as the private sector becomes more innovative, it tends to predominate. Thus in Korea the most US patents are taken out by the private sector, in particular in electronics. In India, the public sector is still predominant, but there are signs of increased patenting activity in the private sector. For instance, in 2001, two of India's leading pharmaceutical companies were granted 11 patents in the US, compared to 58 for India's Council of Scientific and Industrial Research. Source: http://www.uspto.gov/web/offices/ac/ido/oeip/taf/asgstc/inx_stc.htm

[13] Penrose, E. (1951) *"The Economics of the International Patent System"*, The John Hopkins Press, Baltimore, pp.116-117.

[14] Machlup, F. (1958) *"An Economic Review of the Patent System"*, US Government Printing Office, Washington DC, p.80.

[15] Thurow, L. (1997) "Needed: A New System of Intellectual Property Rights", *Harvard Business Review*, Sept.-Oct. 1997, p.103. Source: http://harvardbusinessonline.hbsp.harvard.edu/b01/en/hbr/hbr_home.jhtml

[16] Lessig, L. (1999) "The Problem with Patents", Industry Standard, 23 April 1999. Source: http://www.thestandard.com/article/display/0,1151,4296,00.html

[17] Sachs, J. "The Global Innovation Divide", in Jaffe, A., Lerner, J. and Stern, S. eds. (forthcoming) "Innovation Policy and the Economy: Volume 3", MIT Press, Cambridge MA. Source: http://www.nber.org/books/innovation3/

[18] See Glossary for definition.

[19] The Brief for the Petitioners summarises their case as follows: "These repeated blanket extensions of existing copyright terms exceed Congress's power under the Copyright Clause, both because they violate the "limited Times" requirement and because they violate this Court's "originality" requirement. They violate the "limited Times" requirement, first, because terms subject to repeated, blanket extensions are not "limited"; second, because a term granted to a work that already exists does not "promote the Progress of Science"; and third, because the grant of a longer term for already existing works violates the Copyright Clause's quid pro quo requirement—that monopoly rights be given in exchange for public benefit in return." Source: http://eon.law.harvard.edu/openlaw/eldredvashcroft/supct/opening-brief.pdf

[20] Source: http://www.myoutbox.net/poar1858.htm

[21] See Glossary for definition.

[22] Machlup, F. & Penrose, E. (1950) "The Patent Controversy in the Nineteenth Century". *The Journal of Economic History,* vol. 10:1, p.20.

[23] Although patent examiners and others might question whether the award of a patent leaves "nothing to anyone's discretion."

[24] Machlup & Penrose (1950), p.24.

[25] Penrose (1951), pp. 120-124.

[26] Compulsory working provided an obligation of various kinds under patent law to ensure that patented goods were manufactured domestically, rather than imported into the country where the patent was granted.

[27] Schiff, E. (1971) *"Industrialisation Without National Patents: The Netherlands 1869-1919, Switzerland, 1850 – 1907"*, Princeton University Press, Princeton.

[28] See Glossary for definition.

[29] The Act provided, inter alia, for only process protection (for a period of seven years) in food, drugs and chemicals. This allows patented drugs to be reverse engineered, provided a different process is used in manufacture.

[30] See Glossary for definition.

[31] Kumar, N. (2002) "Intellectual Property Rights, Technology and Economic Development: Experiences of Asian Countries", Commission on Intellectual Property Rights Background Paper 1b, Commission on Intellectual Property Rights, London, pp.27-35. Source: http://www.iprcommission.org

[32] World Bank (2001a) *"Global Economic Prospects and the Developing Countries 2002: Making Trade Work for the World's Poor"*, World Bank, Washington DC, p. 133. Source: http://www.worldbank.org/prospects/gep2002/

[33] US Department of Commerce, Bureau of Economic Analysis, various publications.

[34] World Bank (2001b) *"World Development Indicators 2001"*, World Bank, Washington DC, Table 5.11. Source: http://www.worldbank.org/data/wdi2001/

[35] See Glossary for definition of the terms used in this sentence.

[36] Khan, Z. (2002) *"Intellectual Property and Economic Development: Lessons from American and European History"*, Commission on Intellectual Property Rights Background Paper 1a, Commission on Intellectual Property Rights, London. p.16. Source: http://www.iprcommission.org

[37] Maskus, K. & McDaniel, C. (1999) "Impacts of the Japanese Patent System on Productivity Growth". *Japan and the World Economy*, vol. 11, pp.557-574.

[38] Dahab, S. (1986) "Technological Change in the Brazilian Agriculture Implements Industry", Unpublished PhD dissertation, Yale University, New Haven; and Mikkelsen, K. (1984) *"Inventive Activity in Philippines Industry"*, Unpublished PhD dissertation, Yale University, New Haven.

[39] This draws on Maskus and McDaniel (1999) and Kumar (2002).

[40] Mansfield (1986).

[41] Thomas, S. "Intellectual Property in Biotechnology SMEs", in Blackburn, R. (ed.) (in press) *"Intellectual Property and Innovation Management in Small Firms"*, Routledge, London.

[42] Conclusions of ESRC Intellectual Property Research Programme. Source: http://info.sm.umist.ac.uk/esrcip/background.htm

[43] See discussion in Kumar (2002), p.6 and in Maskus (2000a), p.169.

[44] Gould, D. & Gruben, W. (1996) "The Role of Intellectual Property Rights in Economic Growth", *Journal of Development Economics*, vol. 48, pp 323-350.

[45] See discussion in Maskus (2000a), pp.102-109.

[46] WIPO Statistics. Source: http://www.wipo.int

[47] With per capita incomes between $2976 and $9205 in 2001, the World Bank's upper middle income group of developing countries. Source: http://www.worldbank.org/data/countryclass/countryclass.html

[48] Maskus, K. & Penubarti, M. (1997) "How Trade-Related Are Intellectual Property Rights?" *Journal of International Economics*, vol. 39, pp. 227-248; and Smith, P. (1999) "Are Weak Patent Rights a Barrier to US Exports?", *Journal of International Economics*, vol. 48, pp.151-177.

[49] Maskus (2000a), p.113.

[50] Discussions of this literature are in Maskus (2000a), pp.119-142; and Kumar (2002), pp.11-18.

[51] Maskus (2000a), p.131.

[52] Maskus, K. (2000b) *"Intellectual Property Rights and Foreign Direct Investment"*, Policy Discussion Paper No. 0022, University of Adelaide, Adelaide, pp.2-3. Source: http://www.adelaide.edu.au/CIES/0022.pdf

[53] One passing mention while describing the agreement at Doha in World Bank (2002) *"Global Development Finance 2002"*, World Bank, Washington DC. Source: http://www.worldbank.org/prospects/gdf2002/

[54] UN General Assembly paper A/55/1000, June 26 2001. IPRs are mentioned but not in the discussion of private capital flows or foreign direct investment.

[55] World Bank/Confederation of Indian Industries (2002) "Improving the Investment Climate in India" Draft, World Bank Group, Washington DC. Source: http://www.worldbank.org/wbi/corpgov/core_course/core_pdfs/roger_india.pdf

[56] Mansfield, E. (1994) "*Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer*", International Finance Corporation Discussion Paper 19, IFC, Washington DC. Source: http://www.ksg.harvard.edu/dvc/ifcintellprop.pdf

[57] The history and current implications are reviewed in Patel, S., Roffe, P. & Yusuf, A. (2001) "*International Technology Transfer: The Origins and Aftermath of the United Nations Negotiations on a Draft Code of Conduct*", Kluwer Law International, The Hague.

[58] See: http://www.wto.org/english/tratop_e/dda_e/dohaexplained_e.htm#technologytransfer

[59] The National Institutes of Health (NIH) in the US has recently proposed a policy to vest the worldwide IP rights derived from foreign research collaborators in the US Government, except in the collaborator's own country. Source: http://grants.nih.gov/grants/guide/notice-files/NOT-OD-02-039.html

[60] Source: http://www.research-alliance.net