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Chapter 3

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Intellectual Property Rights and Other Incentive Mechanisms for Learning and Innovation

Chapter 3

A. Introduction

Building strong domestic productive capacities is central to faster economic growth and diversification in LDCs. The objective of this chapter is to explore the current controversies about how a strong intellectual property rights (IPR) regime, as encouraged by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), affects the economic development processes of LDCs and the range of policy issues related to facilitating technological development, through the lens of development economics rather than a narrow legalistic perspective. It will begin with an overview of some of the general global IPR trends, seen through the prism of LDCs (section B), and discuss the "knowledge trade-off" underlying the rationale for IPRs and its applicability to LDCs (section C). It will then examine some of the available secondary evidence regarding the impact of IPRs on learning and innovation and present the findings of an original case study on the impact of IPRs on innovation in the domestic processing sector in Bangladesh (section D). The chapter will also assess the impact of TRIPS and TRIPS-plus obligations on the learning trajectories of LDCs and whether prescribed flexibilities for LDCs are working as promised. Section E, on policy implications, will revisit some widely used incentive and policy mechanisms and section F will consider several new proposals for improving knowledge governance. Conclusions and main policy recommendations are set out in section G.

The term "intellectual property rights" (IPRs) refers to those legal rules, norms and regulations that prevent the unauthorized use of intellectual products.

B. Trends in intellectual property protection

1. Intellectual property protection and the governance of knowledge

The term "intellectual property rights" (IPRs) refers to those legal rules, norms and regulations that prevent the unauthorized use of intellectual products. IPRs cover a broad range of subjects, inter alia, patents, copyrights, trademarks, geographical indications, industrial designs and trade secrets. The chapter will focus, however, on patents and copyright. Intellectual Property (IP) essentially consists of two domains: one deals with industrial products (which includes patents, trademarks, industrial designs and geographical indications of source) and the other with artistic products (which are covered by copyright and related rights). Once IPRs are established, its owner enjoys certain specified rights in terms of its duration (20 years for patents and life plus 50 years for copyrights). IPRs can be issued on products and processes: patents are usually issued for a technical device, or engineering principle after an investigation into its anteriority,

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and in exchange for the public divulging of the technical details. Patents can also be granted, inter alia, for crops, genes, and drugs. A patent confers negative rights, i.e., the right to exclude others from certain activities (TRIPS Article 28).

The copyright is granted for the expression of an idea, not the idea itself. It essentially provides the "right to copy" an original creation, such as poems, theses, plays, literary works, choreographic works, musical compositions, audio recordings, paintings, drawings, sculptures, photos, software, radio and television broadcasts, and sometimes industrial designs.

The growing economic importance of intellectual property has been accompanied by more qualitative changes in intellectual protection, all of which point to a considerable tightening of the rules governing access to knowledge.

The boundary between those domains has, in some respects, been eroding in recent years, owing to the fast rates of diffusion of scientific innovations that blur the boundaries between patentable and copyrightable subject matters and its more widespread use as a source of corporate profits, as well as to the convergent use of new technologies across sectors in what is increasingly being referred to as the "knowledge economy" (OECD, 1999).[1] Measuring the knowledge economy is subject to methodological and statistical shortfalls of various kinds, not least the limits of existing economic categories and classifications (Foray, 2000: chapter 1). The "copyright industries" have not only grown significantly in recent years, but have also expanded beyond their traditional core to encompass a wider set of activities in which knowledge is an important input in the production process. According to recent estimates for the United States, copyright industries contribute between 7 and 11 per cent of output and between 4 million and 8.5 million jobs. At the same time the number of patent applications has been growing rapidly, and licensing and cross-licensing (section B of this chapter) are being used more frequently.

These trends, which attest to the growing economic importance of intellectual property, have been accompanied by more qualitative changes in intellectual protection, all of which point to a considerable tightening of the rules governing access to knowledge. The 1990s witnessed a series of major changes in the patent system that reduced patentability thresholds for patents and expanded the scope of legitimate subject matter to include genetically modified organisms (GMOs), software and business methods. The reform of the United States copyright law in the late 1990s, which extended the duration (term) of copyright to a life plus 70 years model,[2] culminating in the Digital Millennium Copyright Act (1998), was followed by the European Union Copyright Directive (EUCD) in 2001. There have also been other legislative changes in the advanced economies to strengthen enforcement, such as the EC Database Directive, which provides exclusive rights on non-creative databases. Moreover, concerns are intensifying as regards increased use of "defensive patents" or strategic use of patents (Hall, 2005), as well as over increasing restrictions on statutory private use exceptions or "fair use"(Burk and Cohen, 2001; UNCTAD and ICTSD, 2003a; Musungu, 2005). The process of tightening intellectual property protection has been reflected in the increased control over knowledge, information and culture by a small number of very large corporations often operating in highly concentrated markets (Teece, 1995; Macmillan, 2005; David and Foray, 2003). Indeed, the protection of intellectual property has in recent years moved from a defensive to an offensive corporate strategy, including deterring entry of potential rivals (Robledo, 2005), as patents and copyrights are increasingly seen as a unique means of generating value from intangible assets.

Over the last two decades, together with policy advice from donors and multilateral organizations, developing countries, including LDCs, have been strongly encouraged to broaden the scope of IP protection, irrespective of their own needs and conditions.

However, efforts to tighten protection have not been confined to domestic legislation. Over the last two decades, as a result of strong corporate lobbying in some key sectors, together with policy advice from donors and multilateral organizations, developing countries, including LDCs, have been strongly encouraged to broaden the scope of IP protection, irrespective of their own needs and conditions. This pressure has been channelled through multilateral,

regional and bilateral obligations: the TRIPS Agreement, the WIPO Internet treaties (1996), regional free trade agreements, bilateral investment treaties and a number of other international trade agreements.

Advocates of stringent IPRs have insisted that they will encourage technology transfer, stimulate innovation and bring collateral benefits by strengthening the investment climate and attracting more foreign direct investment (FDI), which in turn will improve welfare (Pires de Carvalho, 2002; Sykes, 2002; Fisch and Speyer, 1995). Consequently, intellectual property has been labeled a "power tool for economic development and wealth creation" (Idris, 2003). But there are strong opposing arguments.

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2. Some trends in IP protection, worldwide and in LDCs

Although patent systems diverge significantly across countries, patent statistics can be regarded as one measure of a country's inventive activity and related technology flows (WIPO, 2006). Recent patenting trends indicate that patent filings worldwide have grown on average by 4.8 per cent per annum over the past 10 years (reaching 1.6 million in 2004); and patents granted have also increased at a similar rate. However, while some emerging economies (India, Brazil and Mexico) are making increasing use of the patent system, it remains highly concentrated with the United States, Japan, the Republic of Korea, China and the European Patent Office accounting for 74 per cent of all patents granted (WIPO, 2006).

The available data on patenting trends in LDCs from WIPO and the World Bank (World Development Indicators online) are not totally consistent (tables 21 and 22). However, they both show similar patterns, namely:

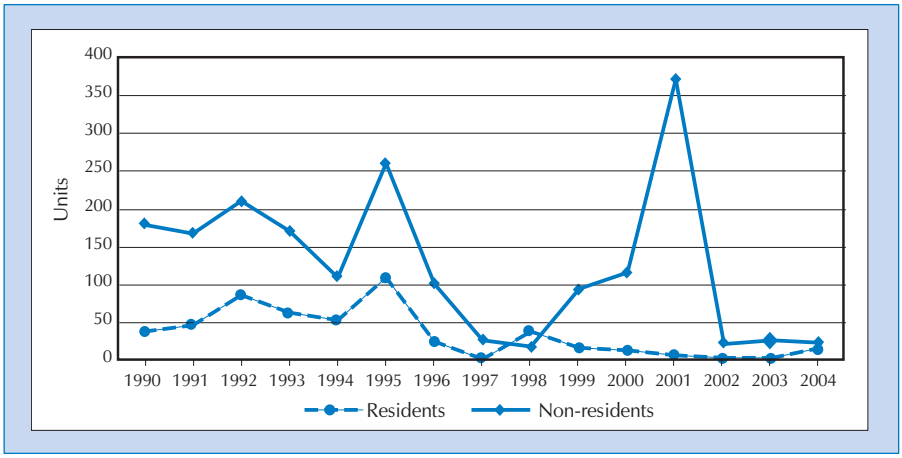
- LDCs share of global patents is insignificant; and
- Overall in LDCs patent applications by non-residents exceeded those by residents.

Recent patenting trends indicate that patent filings worldwide have grown on average by 4.8 per cent per annum over the past 10 years... But LDCs' share of global patents remained insignificant.

The World Bank data also show that there was a downward trend in domestic patenting activity by LDC residents (chart 10 and table 21).

According to available data, between 1998 and 2004, trademarks and industrial designs played a far greater role than patents for LDC residents. Data on industrial design applications suggest that in Bangladesh, residents made 680 applications, compared with 251 in Yemen and 123 in Madagascar (table 22).

Chart 10. Patent applications in LDCs by residents and non-residents, 1990–2004



Source: World Bank, *World Development Indicators*, online, 2007.

Table 21. Patent applications by LDC residents and non-residents, 1990–2004

Year	Patent applications, non-residents	Patent applications, residents
1990	179	39
1991	168	47
1992	210	86
1993	171	63
1994	109	53
1995	260	110
1996	102	25
1997	26	2
1998	18	39
1999	95	16
2000	117	13
2001	372	7
2002	22	4
2003	26	3
2004	24	16

Source: World Bank, *World Development Indicators,* online, 2007.

Table 22. Industrial property applications in LDCs, by residents and non-residents, latest years

Country	Year	Patent applications		Trademark applications		Industrial design applications	
		Residents	*Non-residents*	*Residents*	*Non-residents*	*Residents*	*Non-residents*
Bangladesh	2003	58	260	4 085	1 310	680	10
Benin	1998	..	..	20 908	3 008	..	..
Bhutan	1997–2002	..	..	7	2 020	..	..
Burundi	2002	..	..	20	132	..	..
Cambodia	2003	..	..	297	1 559	..	..
Djibouti	2000	..	..	408[a]	..	..	..
Gambia	2001	..	55	..	..	..	9
Haiti	1999	1	5	150	1306	..	..
Lao People's Democratic Republic	2002	..	..	19	672	..	..
Lesotho	2001	1	54	..	19	..	1
Madagascar	2002	4	..	162	293	123	..
Malawi	2002	..	1	138	440	10	12
Mauritania	2002	6	..	9	..	0	..
Mozambique	2001	1	52	..	..	..	12
Nepal	2001	3	11	1 148	418	3	18
Rwanda	1999	..	4	5	124	..	..
Samoa	2000	..	15	16	357	0	0
Sierra Leone	2001	1	51	..	..	..	9
Sudan	2001	1	54	..	..	..	9
Uganda	2001	2	58	..	14	..	9
United Republic of Tanzania	2001	2	54	..	16	..	11
Yemen	2004	63	788	6 865	24 169	251	50
Zambia	2001	6	25	213	582	7	9

Source: UNCTAD secretariat compilation based on WIPO, Guide To Intellectual Property Worldwide, Country Profiles, last updated September 2006.

Note: Data are available only for the above-reported LDCs.

a Denotes figure for non-residents and residents combined. Data on the composition of patents are not available.

Non-resident applications were not as significant, with the exception of Yemen (50 applications made). As regards trademark applications by residents, 20,908 applications were made in Benin, compared with 6,865 in Yemen and 1,148 in Nepal, while non-resident applications were sizeable in several LDCs (table 22). The low level of patenting activity by LDC residents mirrors low levels of R&D expenditure. According to the most recent data, gross domestic expenditure on R&D (GERD) in Burkina Faso amounted to 0.17 per cent of GDP, while the percentage was 0.0064 per cent for Lesotho, 0.12 per cent for Madagascar, 0.67 per cent for Nepal, 0.34 per cent for Sudan, 0.81 per cent for Uganda, 0.0081 per cent for Zambia and 0.6 per cent for Bangladesh (chapter Introduction to this Report, table 1). This compares with, for example, 1.3 per cent in China and 0.98 per cent in Brazil.

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As regards licensing activities in LDCs, available data indicate that licensing has not increased on a per capita basis since the conclusion of the TRIPS Agreement: licence payments on a per capita basis were the lowest in the world ($0.07) between 2000 and 2005, and have remained unchanged since the period 1996–1999. The comparable figure in other developing countries was $6.36 per capita (in 2000–2005), which was almost double the figure for the previous period (1996–1999): $3.55 (chapter 1, table 16).

3. LDCs in the TRIPS-based policy regime

It is generally accepted that the issue of intellectual property entered multilateral trade negotiations in the Uruguay Round largely as a result of the concerted pressure of the United States, European and Japanese pharmaceutical and international entertainment companies (Shukla, 2000; Drahos and Braithwaite, 2004).

In line with their WTO obligations under the TRIPS agreement, WTO members must also comply with most provisions of the Paris Convention on Industrial Property and the Berne Convention on Literary and Artistic Works, and particularly provisions of the Treaty on Intellectual Property in Respect of Integrated Circuits. Currently, 35 LDCs are parties to the Paris Convention and 29 are parties to the Berne Convention (table 23). As a result, LDCs are obliged to apply the same "minimum" IP standards as soon as the transitional periods expire or upon graduation. In many cases, TRIPS-plus regulations impose on LDCs even higher standards and obligations than on other WTO members.

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The 1994 TRIPS Agreement obliges all signatory countries to grant patents for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application, without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced (Article 27). Since the conclusion of the TRIPS Agreement, IP protection has been extended to include items that were previously unprotected in most developing countries, such as computer programmes, integrated circuits, plant varieties and pharmaceuticals. The original transition period granted to all LDC members of the WTO (until 2006) was extended until 1 July 2013, and until 2016 for pharmaceutical products and related processes.

The TRIPS Agreement[5] recognized that the implementation of high standards of IP protection would be difficult for LDCs to implement immediately, granting a 10-year transition period and providing for technical assistance for "the preparation of laws and regulations on the protection of intellectual property rights as well as for the prevention of their abuse".

Table 23. LDC membership in selected intellectual property conventions, as at February 2007

	Paris Convention *(Industrial Property)*	Berne Convention *(Literary and Artistic Works)*	WIPO Copyright Treaty
WTO LDCs			
Angola			
Bangladesh	X	X	
Benin	X	X	
Burkina Faso	X	X	X
Burundi	X		
Cambodia	X		
Central African Republic	X	X	
Chad	X	X	
Dem. Rep. of the Congo	X	X	
Djibouti	X	X	
Gambia	X	X	
Guinea	X	X	
Guinea-Bissau	X	X	
Haiti	X	X	
Lesotho	X	X	
Madagascar	X	X	
Malawi	X	X	
Maldives			
Mali	X	X	X
Mauritania	X	X	
Mozambique	X		
Myanmar			
Nepal	X	X	
Niger	X	X	
Senegal	X	X	X
Sierra Leone	X		
Solomon Islands			
Togo	X	X	X
Uganda	X		
United Rep. of Tanzania	X	X	
Zambia	X	X	
Non-WTO LDCs			
Afghanistan			
Bhutan	X	X	
Cape Verde		X	
Comoros	X	X	
Equatorial Guinea	X	X	
Eritrea			
Ethiopia			
Kiribati			
Lao PDR	X		
Liberia	X	X	
Rwanda	X	X	
Sao Tome and Principe	X		
Samoa			
Somalia			
Sudan	X	X	
Timor-Leste			
Tuvalu			
Vanuatu			
Yemen			
Total	**35**	**29**	**4**

Source: UNCTAD secretariat compilation based on http://www.wipo.org.

The TRIPS Agreement incorporates a number of flexibilities — such as compulsory licensing[6], parallel imports[7] and fair use/fair dealing (or statutory private use, as employed in European continental copyright law, e.g. France, Germany, Italy, etc.)[8] — that the LDCs can utilize in order to make possible the use of TRIPS-compatible norms in a manner that enables them to pursue their own regulatory policies. However, this does not imply that flexibilities are necessarily utilized. Firstly, TRIPS flexibilities are not utilizable in the LDCs unless legislation is drafted to incorporate them into national laws. Secondly, under regional arrangements for IP protection, many of those flexibilities cannot be utilized owing to membership of regional IP organizations, such as Organisation Africaine de la Propriété Intellectuelle (OAPI) (12 out of whose 16 members are LDCs; table 24) and the African Regional Intellectual Property Office (ARIPO). Thirdly, those flexibilities cannot be used because of commitments undertaken at the bilateral level[9] (table 25).

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Other flexibilities include exceptions to patent rights such as the Bolar exception, government use and experimental use exceptions. Developing countries are advised to interpret the flexibilities in the widest way possible, and to incorporate explicit provisions into their national patent laws (CIPR, 2002). With respect to exceptions to patent rights,[10] under TRIPS, LDCs have considerable flexibility as regards promotion of transfer of technology, prevention of abuse of intellectual property rights and protection of public health. However, TRIPS-plus regulations limiting flexibilities, already operative in many LDCs, are likely to have an adverse impact on their access to the global pool of knowledge, which may further constrain national policy. When the Agreement on Trade-Related Investment Measures (TRIMs) (which discourages local content requirements) is also taken into account, it is clear that LDC prospects for effective industrial policy and learning are greatly diminished (UNCTAD, 2006c).

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Table 24. LDC membership in regional intellectual property organizations, 2007

LDC	ARIPO	OAPI
Benin		X
Burkina Faso		X
Central African Republic		X
Chad		X
Equatorial Guinea		X
Gambia	X	
Guinea		X
Guinea Bissau		X
Lesotho	X	
Malawi	X	
Mali		X
Mauritania		X
Mozambique	X	
Niger		X
Senegal		X
Sierra Leone	X	
Somalia	X	
Sudan	X	
Togo		X
Uganda	X	
United Republic of Tanzania	X	
Zambia	X	
Total	**10**	**12**

Source: UNCTAD secretariat compilation based on African Regional Intellectual Property Organization (ARIPO), http://www.aripo.org; and Organisation Africaine de la Proprieté Intellectuelle (OAPI), http://www.oapi.wipo.net.

Table 25. Intellectual property requirements in bilateral agreements between the United States and selected LDCs

	TRIPS-plus area	Definition of Investment includes Intellectual property
Bilateral United States–LDC BIT Agreements		
United States–Bangladesh Bilateral Investment Treaty (1986)	Requirement to accede to the Budapest Convention (micro-organisms)	Article 1c) "Investment" means every kind of investment owned or controlled directly or indirectly, including equity, debt; and service and investment contracts; and includes…. (iv) Intellectual property, including rights with respect copyrights and related patents, trade marks and trade names, industrial designs, trade secrets and know-how, and goodwill;
United States–Democratic Republic of the Congo Bilateral Investment Treaty (1984)		Article I c) "Investment" means every kind of investment, owned or controlled directly or indirectly, including equity, debt, and service and investment contracts; and includes: (iv) intellectual and industrial property rights, including rights with respect to copyrights, patents, trademarks, trade names, industrial designs, trade secrets and know how, and goodwill;
United States–Mozambique Bilateral Investment Treaty (1998)		Article 1 d) "investment" of a national or company means every kind of investment owned or controlled directly or indirectly by that national or company, and includes investment consisting or taking the form of: (v) intellectual property, including:copyrights and related rights, patents, and confidential business information, trade and services markes, and trade names; rights in plant varieties, industrial designs, rights in semiconductor layout designs, trade secrets, including know how (vi) rights conferred pursuant to law, such as licences and permits; (e) "covered investment under this treaty" means an investment of a national or company of a Party in the territory of the other Party;
United States–Senegal Bilateral Investment Treaty (1990)		Article I (c) "Investment" means every kind of investment, owned or controlled directly or indirectly, including equity, debt, and service and investment contracts; and includes: (iv) intellectual and industrial property rights, including rights with respect to copyrights, patents, trademarks, trade names, industrial designs, trade secrets and know-how, and goodwill;
Bilateral United States–LDC Trade Agreements		
United States–Cambodia Trade Relations and Intellectual Property Rights Agreement	Article 11(1)d : Requirement to join UPOV Convention Article 13(5) Extension of TRIPS copyright terms of duration from 50 to 75 years.[a] Article XVIII (1) a. Requirement for patenting in all fields of technology. TRIPS-plus because no exclusion for animals or plants, as possible under TRIPS Article 27 (3) b. Each Party shall make patents available for any inventions, whether products or processes, in all fields of technology, provided that such inventions are new, result from an inventive step and are capable of industrial application. For the purposes of this Article, a Party may deem the terms inventive step and capable of industrial applications" to be synonymous with the terms non-obvious and "useful," respectively.	
United States–Laos Bilateral Trade Relations Agreement	Includes Intellectual Property Chapter Article 13 (2)d: Requirement to join UPOV Convention Article 18 (5) : Patenting in all fields of technology . TRIPS-plus because no exclusion for animals or plants, as possible under TRIPS Article 27 (3) b. "Patents shall be available and patent rights enjoyable without discrimination as to the field of technology or whether products are imported or locally produced". Article 15 (4): Extension of TRIPS copyright terms of duration from 50 to 75 years[b]	The Agreement includes a specific chapter on Intellectual Property Rights. Definition of Intellectual property rights: Article 28 1 (d): "'intellectual property rights´ refers to copyrights and related rights, trademarks, patents, protection of integrated circuit layout designs and encrypted satellite signals, trade secrets, and protection of plant breeders' rights"

Sources: UNCTAD secretariat compilation based on Agreement between the United States and the Kingdom of Cambodia on Trade Relations and Intellectual Property Rights Protection done at Washington, in duplicate, October 4, 1996. Agreement between the United States and the Lao People's Democratic Republic on Trade Relations, 1997 (http://tcc.export.gov/Trade_Agreements/All_Trade_Agreements/indexasp).

Notes: *a* Article 13(5): "Whenever the term of protection of a work, other than a photographic work or work of applied art, is calculated on a basis other than the life of a natural person, such term shall be no less than 75 years from the end of the calendar year of first authorized publication…"

b Article 15 (4): "Each Party shall provide that, where the term of protection of a work is to be calculated on a basis other than the life of a natural person, the term shall be no less than 75 years from the end of the calendar year of the first authorized publication of the work or, failing such authorized publication within 25 years from the creation of the work, not less than 100 years from the end of the calendar year of the creation of the work".

The inclusion of TRIPS-plus clauses in regional arrangements, in addition to BITs, FTAs and other preferential agreements, can limit the use of flexibilities.[11] The stringent TRIPS-plus standards required, either at the time or immediately following accession to the WTO, are yet another example of the asymmetric treatment accorded in multilateral forums to the most vulnerable and weakest members of the international community.

Even with its inbuilt flexibilities, the TRIPS Agreement is highly problematic for LDCs owing to the high transaction costs involved in complex and burdensome procedural requirements for implementing and enforcing appropriate national legal provisions. LDCs generally lack the relevant expertise and the administrative capacity to implement them. Furthermore, although the Doha Declaration of 2001 was an improvement over TRIPS, especially in the area of health and access to medicines, it does not address the building of technological capacity. Since most LDCs lack sufficient awareness about the full use of flexibilities, WIPO, in cooperation with UNCTAD, should play a more active role in informing those countries about the full range of their possible use.

LDCs generally lack the relevant expertise and the administrative capacity to implement the legal provisions of the TRIPS Agreement.

The majority of non-African LDCs seem to confer patent protection for pharmaceutical products by applying the legislation of the countries whose colonies they once were (Correa, 2007). Despite the extension period, practically all African LDCs have followed suit, and this includes the granting of patents for pharmaceuticals. In the spirit of Article 66.1 of the TRIPS Agreement and paragraph 7 of the Doha Declaration (2001), which exempt LDCs from both making available and enforcing patents, and test data protection, they have the option of not enforcing granted patents and allowing competition in the relevant product market.

Various flexibilities allow LDCs to use TRIPS-compatible norms in a manner that enables them to pursue their own public policies, and to establish economic conditions supportive of their economic development objectives. While these flexibilities are mainly defined in terms of more generous implementation times, they also include exemptions in areas such as public health, where rules on compulsory licensing, parallel imports and experimental use are more relaxed. Table 25 provides a non-exhaustive list of selected examples regarding the nature of TRIPS-plus requirements in both bilateral investment agreements and bilateral trade agreements between a number of LDCs and their partners. For example, Article 11 D of the trade relations and intellectual property agreement between the United States and Cambodia (1996) limits Cambodia's scope for flexibility with respect to adopting a particular type of sui generis system for plant protection, which requires Cambodia to join the International Convention for the Protection of New Varieties of Plants (the UPOV Convention).[12]

Various flexibilities allow LDCs to use TRIPS-compatible norms in a manner that enables them to pursue their own public policies, and to establish economic conditions supportive of their economic development objectives.

Similarly, the Lao People's Democratic Republic and Bangladesh have entered into bilateral agreements with the United States that contain TRIPS-plus requirements (table 25). Moreover, the European Union and Bangladesh Cooperation Agreement on Partnership and Development (1999) encourages Bangladesh's adoption of the UPOV Convention by 1 January 2006. The EU Cotonou Agreement (2000) with ACP countries includes patenting for biotechnological inventions and plant varieties, as well as legal protection of databases, as part of its list of intellectual property rights falling within the scope of the Agreement.[13] All African LDCs belong to the ACP group.

(a) Free trade agreements and TRIPS-plus obligations

Owing to the TRIPS Agreement's inbuilt flexibilities, more stringent IP requirements have been negotiated in regional and bilateral agreements. The inclusion of these so-called TRIPS-plus clauses further limits the use of the

flexibilities negotiated at the multilateral level, as witnessed in the mushrooming of Free Trade Agreements (FTAs), whose number has increased sixfold in just two decades (Roffe and Vivas, 2007). For example, some FTAs require that countries not make use of parallel imports, extend the duration of the copyright, while others restrict the grounds for compulsory licences. Some FTAs also impose data exclusivity clauses which restrict the use of the patent holder's test data as the basis for granting safety approval of the generic versions of the same drug.[14] For example, compliance with TRIPS and "going beyond TRIPS"[15] are one of the eligibility requirements for benefits under the preferential scheme of the United States' African Growth and Opportunity Act (AGOA).[16]

More stringent IP requirements have been negotiated in regional and bilateral agreements. The inclusion of these so-called TRIPS-plus clauses may limit the use of the flexibilities negotiated at the multilateral level, especially so in the mushrooming of Free Trade Agreements.

(b) Regional cooperation and regional intellectual property systems in the LDCs

Regional cooperation may offer some advantages as regards lower transaction costs and regional harmonization, but also disadvantages if regional commitments are of a TRIPS-plus nature, implying a higher level of commitments than stipulated under the TRIPS Agreement (table 24). LDC members of OAPI cannot take advantage of an extended transition period or a longer extension on pharmaceutical product protection (granted at Doha) unless the Bangui Agreement is amended specifically for that purpose (CIPR, 2002). The Bangui Agreement includes TRIPS-plus commitments that require TRIPS compliance prior to the agreed LDC extension deadline. The Bangui Agreement furthermore contains no exclusions from patentability. Unless amended, the Bangui Agreement will continue to restrict the issuance of compulsory licences to a greater extent than required by TRIPS.[17] The LDCs concerned should seriously consider the implications of that restriction.

4. Calls for reform

After two decades of steadily increasing IP protection there are growing concerns about how far that process has gone. Increasingly, developing countries, including the LDCs, are concerned that the development dimension is not sufficiently integrated into global IP policymaking. In 2004, WIPO launched discussions on a Development Agenda, prompted by the recognition of global knowledge asymmetries and the need for greater integration of a development dimension into global IP policymaking. (CIPR, 2002; WIPO, 2007b). [18]

After two decades of steadily increasing IP protection there are growing concerns about how far that process has gone. Increasingly, developing countries, including the LDCs, are concerned that the development dimension is not sufficiently integrated into global IP policymaking.

Recently, the Committee on Proposals Related to a WIPO Development Agenda (WIPO, 2007b) called for reform of the current IPR regime that would promote a better-balanced international system adapted to the requirements of developing countries. That reform would emphasize "the transfer of technology and access to knowledge and information, crucial to developing countries in stimulating innovation and creativity" (WIPO, 2007b: 15). During recent WIPO meetings on the Development Agenda (February 2007), various developing countries, including several LDCs, expressed their concerns about the possible adverse impact of stringent IPRs on the condition of the poor and strongly emphasized the need for impact assessment before the implementation of new IP instruments. The philosophy underlying the Development Agenda at WIPO is that IP protection should be enacted in accordance with the level of development of different countries and that protection of private interests should be balanced with that of the larger public interest (section E of this chapter). In a similar vein, the Secretary-General of the United Nations, Mr. Ban Ki-moon, has stated that "[t]he rules of intellectual property rights need to be reformed, so as to strengthen technological progress and to ensure that the poor have better access to new technologies and products" (www.un.org/ecosoc).

Similar concerns reflect the fact that in a world where most developing countries, and just about all LDCs, are net importers of technology and depend on externally generated knowledge, the current IPR regime may hinder or prevent catch-up strategies. This locks poorer countries even more firmly into a low-technology, low-valued added growth path and further widens the knowledge divide between those countries and developed countries, where 97 per cent of the world's patents are currently held (UNESCO, 2005). Accordingly, assessing the impact of growing Intellectual Property Protection (IPP) on the learning process in LDCs cannot be divorced from its overall impact on development.

The current IPR regime may hinder or prevent catch-up strategies, thus locking poorer countries even more firmly into a low-technology, low-value-added growth path and further widening the knowledge divide between those countries and developed countries.

Moving beyond current arrangements means seeing IPRs not as an end in themselves, but as a means for development, growth and poverty reduction. Three options are currently under consideration. The first of these recognizes that current agreements still leave some room to achieve objectives with respect to the promotion of the transfer of technology, and seeks to design strategies that can make full use of that space (UNCTAD, 2006c). The second option suggests that given the technological constraints facing developing countries, some degree of roll-back (or opting out) is needed in the TRIPS agreement to better accommodate development needs (Rodrik, 2001; South Centre, 2002). The third option seeks to create new modalities for IPP that will better accommodate developing country needs. Those options, which need not be mutually exclusive, will be taken up in greater detail in section E.

C. Effects of IPRs on LDCs

1. IPRs and the knowledge trade-off

Ideas are among the most complex creations of human endeavour. Understanding what exactly they are and the creative processes behind them has alternately fascinated and frustrated philosophers and social thinkers for millennia. Economists tend to take a more prosaic perspective. Ideas matter to the extent that they fuel innovations and enhance economic growth and welfare. The positive impact of innovation on economic growth has been widely accepted in the economic literature, as far back as Adam Smith's pin factory. Indeed, in many accounts innovation is the primary engine of long-term development; to borrow the title of an article by two leading historians of technological development, innovation is "how the west grew rich" (Rosenberg and Birdzell, 1986). Certainly, the greater the number of individuals, firms or countries that have access to superior products and processes, and the sooner they have such access, the more widespread and substantial will be the economic benefits (Baumol, 2002). For poorer countries, seeking to initiate and sustain catch-up growth, access to the knowledge possessed by those higher up the development ladder is generally considered to offer a key ingredient in a virtuous circle of strong capital formation and technological progress.

Moving beyond current arrangements means seeing IPRs not as an end in themselves, but as a means for development, growth and poverty reduction.

That said, conventional economics has struggled to integrate innovation into its models, leaving it as at best a "sideshow…excluded from the central ring of the main performance" (Baumol, 2002). In part that is because of the determination of conventional economists to reduce innovation to the workings of the price mechanism. At its worst this leaves innovation as a *deus ex machina* set of freely available and clearly codified instructions that shifts the production possibility frontier, and whose contribution to economic welfare can be easily traced through changes in relative prices. More constructively, innovation is seen as a profit-seeking activity linked, in particular, to R&D. Accordingly, leaving the

market to produce and disseminate new ideas may not be desirable because information problems lead to too many or too few resources being devoted to innovative activity. In particular, because producing new ideas involves the commitment of time and money (often in the form of specialized assets) with an uncertain outcome, it tends to be a high-fixed-cost activity vulnerable to copying by competitors. However, unlike in the case of a public good, it is possible for the creator of an idea to exclude others from using it, although this may damage social welfare by stopping the flow of ideas from reaching those who could use it most effectively. By implication, managing this knowledge trade-off needs non-market (social) mechanisms, of which (intellectual) property rights are seen as the most compatible with the working of market forces.

That perspective still tends to define innovation as pioneering activity to develop a new product or processes and is rooted in the rational behaviour of the firm. It also tends to assume that knowledge spills over rather easily from its original source. It thus underestimates the peculiar properties of knowledge as an economic good that makes innovation a much more complex process than is allowed in equilibrium models (Foray, 2000). In particular, it fails to acknowledge the tacit and local nature of much knowledge, which renders imitation arduous, since it underestimates the interactive and cumulative nature of the learning process that accompanies the production of knowledge.

Strengthening incentives to innovate depends on a broad range of economic, social and political factors, including the knowledge ecology, or the set of institutions that enable access to, and production and use, of knowledge for learning and innovation.

Strengthening incentives to innovate depends on a broad range of economic, social and political factors, including the knowledge ecology, or the set of institutions that enable access to, and production and use, of knowledge for learning and innovation (Dasgupta, 2007). The knowledge ecology represents the institutional framework devised to optimize access to, and production and use of, knowledge. The existence of property rights and the rule of law are certainly amongst the inducement incentives, but they do not act alone. A degree of political stability as well as clear-sighted leadership will also have a role in encouraging a climate where citizens are willing to invest in change, as will basic social factors such as health and safety standards and life expectancy. However, a range of government policies with respect to taxation, competition, human capital and the investment climate will be important in establishing the incentives to encourage the development of absorptive capacity at both firm and national levels. At the same time, the banking and financial system will have a pivotal role in releasing resources for capability building (Rogers, 2004).

Thus, the effectiveness of inducement mechanisms for innovation will largely depend on a country's knowledge ecology, or the institutional framework devised to encourage the risk-taking involved in any innovative endeavour, and not merely R&D, and the level of its technological absorptive capacity, or the ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends (Cohen and Levinthal, 1990).

As discussed in chapter 2 of this Report, the market mechanism needs to be supported in order to generate the climate for Schumpeterian entrepreneurship and innovation. The role of IPRs as inducement mechanisms for innovation can be evaluated adequately only in that context. Thus, unlike in conventional economics, the institutions associated with innovation are constantly evolving and adapting to unpredictable circumstances. In particular, the destructive consequences of innovation mean that it generates adjustments which can be disruptive and costly for (a not necessarily small) subset of citizens, while its intangible, cumulative and interactive dimensions mean that an array of "social capabilities" (Abramowitz, 1986) are implicated in the innovation process and in such a way that initial conditions have a very strong bearing on subsequent success. This also implies that innovation is a more coordinated process than

suggested by conventional models and one which rests on a socio-economic contract between the Government, firms and consumers based on the notion of balance between the rights of the inventors and those of the wider public, and which is, moreover, also committed to making considerable resources available to learning at the micro, meso and macroeconomic levels of innovative activity.

2. IPRs, learning and imitation

Catch-up growth is partly determined by the size of the technology gap which separates the developing from the more advanced economies, and partly by the capability of developing countries to discover new technologies and to absorb more advanced technology already available from abroad (Rogers, 2004). That makes learning a central factor in any successful productive system, but also one that must be calibrated to different levels of economic and industrial development. In the case of LDCs, learning will principally revolve around absorbing already existing techniques and adapting them to specific local conditions, namely by imitation. Such imitation ranges from illegal duplication of standard products to deriving inspiration from the latest cutting-edge gadgets. But in most cases of imitation some kind of "reverse engineering" will be essential, based on a variety of skills and activities which would support a purposive search for relevant information and its development through effective interactions within and among firms and other institutions familiar with knowledge acquired from abroad. In that respect, strong IPR protection is likely to hinder rather than to facilitate technology transfer and indigenous learning activities in the early stages of industrialization (Kim, 2000; CIPR, 2002; Teece, 2005).

In the LDCs, learning will principally revolve around absorbing already existing techniques and adapting them to specific local conditions, namely by imitation. But in most cases of imitation some kind of "reverse engineering" will be essential.

The leading channels for accessing technology from abroad include imported goods, FDI and foreign licensing (see chapter 1 of this Report). The kind of knowledge needed in each case is likely to be different and tailored, policies and institutions will have to be devised to handle the technology transfer challenge. Empirical studies seem to support the hypothesis that stronger IPRs favour licensing through easing the enforcement of contracts and raising imitation costs, and possibly increased FDI inflows (Yang and Maskus, 1998). This contention, however, remains to be tested in the LDCs and is the subject of further research. Moreover, given the broader determinants of FDI and licensing arrangements and recent trends in LDCs (section B of this chapter), it is likely that imitation, based on imported capital goods and informal channels of technology transfer will be crucial for technological progress in most LDCs. However, even here, various social capabilities or absorptive capabilities will be needed if local firms are to benefit from the potential spillovers from imported technology, as has been corroborated by the case study in Bangladesh (subsection D.3 of this chapter).

Firms' capacity to tap into knowledge systems and build technological capabilities is determined by several factors, for example informal interactions with other actors in the knowledge system within which firms operate, such as universities (for human capital provision), financial institutions (for venture capital and financing of research), industrial infrastructure (for manufacturing products or acquiring information related to production) and entrepreneurial associations (for marketing and assessment of market-based conditions). Other actors in the knowledge system provide incentives (or disincentives) for interaction, thereby facilitating (or limiting) a firm's ability to build its technological capabilities (Chesbrough and Teece, 1996). As a consequence, the learning efficiency of firms depends on numerous country-specific institutional, infrastructural and cultural elements that predetermine interactive capabilities, organizational efficiencies and mobility of skills, including a country's knowledge ecology (OECD, 1999).

Intellectual property rights can play an important role in stimulating R&D investments only where absorptive capabilities already exist, provided the compliance costs do not exceed the benefits. But in countries that lack absorptive capabilities, innovation is likely to remain, at best, underdeveloped in the face of greater protection. IPRs can be deemed as beneficial when they foster the development of firm-based innovative capabilities through diffusion of knowledge, technology transfer, foreign direct investments and licensing, among others. However, it is just as possible that patents can block technology transfer under certain circumstances. Firms may withhold technological information from particular countries for competitive reasons, a strategy that is facilitated by globalized IPRs (Gehl Sampath, 2006). The spectrum of anti-competitive deployment of patents that can hinder learning by firms through imitation and reverse engineering looms large in the context of weak competition enforcement in most developing economies (Maskus, 2005). Even where there is no such blockage, the higher costs (for inputs, seeds and intermediate products) may act as a deterrent, particularly in some industries (Sampat et al. 2003). These findings are broadly corroborated by the case study in the domestic processing sector in in Bangladesh (Gehl Sampath, 2007a; subsection D.3 of this chapter).

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Making claims about the unequivocal impact of intellectual property on innovation is also rendered difficult by the fact that knowledge generation, accumulation and diffusion processes are different across sectors and technologies. Mansfield's study on the comparative importance of patents in different industries showed that patents were most important for the development and introduction of products in two industries — the pharmaceutical and chemical industries — where they accounted for over 30 per cent of development activities (Mansfield, 1998). In other sectors, firms tend to rely on a variety of other appropriability mechanisms to protect their innovations, such as secrecy and first-mover advantages, often far more than on patents (Cohen et al., 2001; Arundel, 2001).

Even within sectors where intellectual property is important, a variety of strategic motives prompt firms to use patents as an appropriability mechanism. Such motives include the use of patents as negotiating levers or as tools for prevention of infringement suits, blocking innovations from competitors or capturing extra value for innovative efforts. Excessive market power accumulated through patents can be used by firms to control diffusion of inventions and research results (Gallini and Trebilcock, 1998), and/or to cover entire areas of research or preserve market shares by accumulating "sleeping patents" that help capture extra value for innovative efforts (Barton, 1998; Kanwar and Evenson, 2001; Dumont and Holmes, 2002). Not surprisingly, in a comparative survey of the manufacturing sectors in the United States and Japan, Cohen et al., (2001) found strategic uses of patents to be common in the manufacturing sectors in both countries, with a higher prevalence of strategic patenting in Japan. The electronics industry is also a good example of strategic patenting. Thumm (2004) notes from the results of a survey of the Swiss biotechnology industry that, apart from protecting one's own technology from imitation, the second most prominent reason for patenting was to prevent competitors' patenting and application activities.

Intellectual property rights can play an important role in stimulating R&D investments only where absorptive capabilities already exist, provided the compliance costs do not exceed the benefits. But in countries that lack absorptive capabilities, innovation is likely to remain, at best, underdeveloped in the face of greater protection.

Recent attention concentrated on strengthening property rights as the way to establish the right innovation climate is likely to have been damaging for LDCs where the premium is on imitation. That produces an environment that chokes off the kind of reverse engineering options that were successfully used in a previous generation of late industrializing economies. As illustrated by the case study in Bangladesh, without imitation, learning will be made extremely difficult for countries with low technological capacities that rely on licensing for technology transfer only to a very limited degree,[19] (subsection D.3 of this chapter). The

result, as recognized in a recent UNIDO report, may be a widening knowledge gap (UNIDO, 2006).

Property rights can be an obstacle to development insofar as their application directly imposes limits on access to ideas; restricts the policy space needed to build social capabilities; places a heavy burden on development budgets; increases the potential for anti-competitive activity; and reduces technology flows to the poorest countries. Although, these problems may not be immediately felt in low-income economies as IPRs are tightened (Maskus, 2004), because innovation is a cumulative process linked to continuous learning at various levels of society, it would be misleading to conclude that they are absent.

Empirical research on the East Asian economies suggests that relatively weak IPR protection encouraged technological learning during the early industrialization phase.

Although a number of econometric studies on the relationship between IPRs and technology transfer indicate a positive association of both variables,[20] there is little conclusive evidence about the positive impact of IPRs on technology inflows (Correa, 2007). In particular, there is no evidence to suggest that increased protection of IPRs in developing countries will lead to more opportunities for accessing the latest technologies,[21] or that the local rate of innovation will increase. While the availability of IPRs reduces the risk for potential transferors and may encourage formal modes of transfer (such as licensing), the increased power that IPRs give leaves it within title-holders' discretion whether or not to transfer the technologies they possess, and to determine the price and other conditions thereof.[22]

Empirical research on the East Asian economies (Japan, Republic of Korea, Taiwan Province of China) the most successful catch-up economies of the recent (and perhaps any) era, suggests that relatively weak IPR protection encouraged technological learning during the early industrialization phase (Kumar, 2002). The experience of the Republic of Korea's technological development shows that during the implementation of its catch-up strategy, "foreign technology transfer played a vital role in building the existing knowledge base of Korean firms. Simple, mature technologies could be easily obtained free of charge, through informal mechanisms, because they were readily available in various forms. Even if such technology were patented, foreign patent holders were lenient in controlling such duplicative imitation, as it was no longer useful for sustaining their international competitiveness" (Kim, 2003).

The "one-size-fits-all" approach can be a recipe for disaster for developing countries, particularly for least developed countries.

If adequate protection and enforcement of IPRs are genuinely intended to enhance development, policymakers should seriously consider differentiation of IPP in line with countries' level of economic and technological development. Otherwise the "one-size-fits-all" approach can be a recipe for disaster for developing countries, particularly for least developed countries. Developing countries should strengthen their own absorptive capacity for long-term solutions that would enable them to identify relevant technology available elsewhere, strengthen their bargaining power in transferring technology on more favourable terms, assimilate that technology quickly once transferred, imitate and produce creatively and eventually generate their own IPRs (Kim, 2000).

3. Patent excess in the knowledge economy

The traditional consensus on the benefits of stronger IPRs is breaking down. The current IPR regime has been associated with excessive extension of copyright and increasing "strategic use" of patents, both of which are welfare-reducing (Davis, 2002; Bennet, 2002; Robledo, 2005). In many industries, the increasing number of patent applications can be explained not by the need to promote more innovations but by purely rent-seeking purposes — for example, defensive use of

IP portfolios to deter litigation by other firms. This can be used against possible new entrants who might affect the oligopoly rents available to the incumbents, and, therefore, as a tool to deter or even block innovation (Robledo, 2005).

As a result, many industries and technological fields are now characterized by the formation of "patent thickets" — an expression that describes the proliferation of overlapping and not clearly delineated patents. Efforts and costs devoted to sorting out conflicting and overlapping IPR claims are increasing, as is uncertainty about the nature and extent of legal liability in the use of knowledge inputs. Moreover, because the current copyright system grants exclusive rights only to producers of knowledge, and not to users of ideas and knowledge, persistent and divisive disputes contribute to a growing hostility towards traditional IP systems (Steinmueller, 2003).

In many industries, the increasing number of patent applications can be explained not by the need to promote more innovations but by purely rent-seeking purposes.

At the same time, there is growing recognition that patents may not even be necessary since other mechanisms may be more efficient in stimulating innovation, particularly for countries in the "initiation phase" of technological learning. The characteristics of knowledge as a semi-public good do not prevent the first inventor from generating sufficient competitive advantages if the supply of copies of the invention is not immediate — hence the fact that being first is an asset that can be converted into positive prices, even in a private competitive market (Boldrin and Levine, 2004).

Certainly, historical experience confirms that copyright is not needed in order to stimulate creative activity (Gana, 1995). And those who have suggested that innovation is a much more collaborative process argue that the common heritage of information and knowledge ("the Republic of Science") is being threatened and eroded through extended IP protection for works created many years ago.[23]

In the knowledge-intensive global economy, copyright's capacity to limit access to knowledge will necessarily have an adverse impact on LDCs that need access in order to contribute to and benefit from the global research, information and communication system. Knowledge is cumulative and excessive copyright protection is likely to have an adverse impact on LDCs, since they are primarily users of imported knowledge, rather than creators. Developing countries are of the view that they are entitled to less restrictive access to all categories of works, without imposition of excessive technological protection measures (TPM) control mechanisms, especially as regards personal use, research and education (Knopf, 2005; Smiers, 2005).

Efforts and costs devoted to sorting out conflicting and overlapping IPR claims are increasing, as is uncertainty about the nature and extent of legal liability in the use of knowledge inputs.

Moreover, where overprotection distorts the efficient operation of the market for knowledge and ideas, poorer countries are likely to be the biggest losers. The elasticity of supply of creativity should be considered important criteria for determining the appropriate level of protection in the market for ideas, as well as consumer response to the price of creative works (Johnson, 2005).

D. Evidence of the impact of IPRs on learning

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A broad overview of the empirical literature strongly suggests that the effects of IPRs on technology transfers to developing countries depend on a country's level of development, the specific technological fields involved, the level of individual

firms' absorptive capacity, the lifecycle of technologies, the sector in which IPRs are applied, the type of technology used and general market conditions (UNCTAD and ICTSD, 2003a and 2006; UNIDO, 2006; Todo, 2002; Primo Braga and Fink, 1998).[24] That view is corroborated by the case study in Bangladesh (Gehl Sampath, 2007a; subsection D.3 of this chapter). As countries' capacity to innovate depends on a whole range of economic, social and political factors, including intellectual property rights, fiscal policies, competition and finance, macroeconomic and monetary factors (especially the banking and credit system), it is almost impossible to isolate the strength of certain inter-related variables in the innovative process.

The effects of IPRs on technology transfers to developing countries depend on a country's level of development, the specific technological fields involved, the level of individual firms' absorptive capacity, the lifecycle of technologies, the sector in which IPRs are applied, the type of technology used and general market conditions.

Indeed, the absence of IPP may be necessary in order to allow learning through imitation at the initial levels of technological development. IPRs may pre-empt duplicative imitation of foreign technologies which was crucial in the process of technological catching-up of the Republic of Korea and Japan (Kim, 1997). Another telling example is the successful development of the Indian pharmaceutical industry. On the basis of a strong technological capacity in chemistry and pharmaceutical formulation, the Indian generics pharmaceutical industry became a global provider of low-cost medicines and active ingredients in the absence of product patent protection (Chaudhuri, 2005).

There seems to be broad consensus (as implied by Article 66.1 of the TRIPS Agreement) that "in the early stages of their industrial growth, countries are primarily interested 'in being able to imitate imported technologies freely, calling for limited protection" (Maskus, 2005: 60). In addition, internalized forms of technology transfer, (i.e. those taking place intra-firm) are likely to be preferred by technology holders or constitute the only viable option when the absorptive capacity in the recipient country is low and imitation by domestic firms is unlikely. Logically, IPRs will play a neutral role since the transferred technology remains under the foreign firm's control and knowledge spillovers are not common in local firms, even in TNC subsidiaries (Correa, 2007). This was also found to be the case in the manufacturing sector in Bangladesh (Gehl Sampath, 2007a; subsection D.3 of this chapter). Moreover, studies by Glass and Saggi (2002) and Helpman (1993) suggest that the rate of global innovation declines with a reduction in the rate of imitation due to stronger IPRs.

The stated fundamental objective of the TRIPS Agreement is to encourage domestic innovation and international technology diffusion: however, since its adoption the North–South technological gap has continued to grow.

The stated fundamental objective of the TRIPS Agreement is to encourage domestic innovation and international technology diffusion: however, since its adoption, the North South technological gap has continued to grow (Correa, 2007), and the knowledge divide has increased between countries (UNESCO, 2005). Empirical evidence of a causal relationship between stronger IPRs and an increasing level of technology transfer post-TRIPS is non-existent. Moreover, the evidence about whether stronger IPRs stimulate formal technology transfer via trade, FDI, and licensing is also mixed and inconclusive (UNCTAD and ICTSD, 2003a). Benefits, to the extent that they exist, are more likely to come from acceleration in the domestic deployment of advanced technology by the affiliates of foreign firms (Branstetter, 2005). There is more evidence that stronger IPRs will hinder informal channels of inward technology transfer, for example reverse engineering and copying, because of their increased costs for developing countries (CIPR, 2002; UNCTAD and ICTSD, 2003a). Moreover, literature demonstrates a growing concern that stronger IPRs will increase monopoly positions in respect of knowledge, thereby restricting opportunities for learning and technology transfer (David, 2005; Gehl Sampath, 2006; Hoekman, Maskus and Saggi, 2005; Maskus and Reichman, 2005).

An UNCTAD study of 87 countries found wide differences between developing countries with respect to the impact of strengthened TRIPS; the importance of patents fluctuates considerably according to the technological nature of the activity they are engaged in and the technological maturity of the economy (Lall, 2003). The econometric cross-section evidence suggests a U-shaped relationship between the strength of patents and income levels; the intensity of patenting initially falls with increasing income as countries build local capabilities by copying, and then rises as they engage in more domestic innovative efforts. The turning point is $7,750 per capita (in 1985 prices), a figure well above that found in LDCs. The study suggests that weak patents can help local firms in the early stages to build their technological capabilities by permitting imitation and reverse engineering, as borne out by the experience of the newly industrializing South-East Asian economies (Republic of Korea and Taiwan Province of China). Similarly, research by Kim, based on the Korean experience, suggest that "stronger IPR protection will hinder rather than facilitate technology transfer and indigenous learning activities in the early stages of industrialization when learning takes place through reverse engineering and duplicative imitation of mature foreign product" and he argues that "only after countries have accumulated sufficient indigenous capabilities with extensive science and technology infrastructure to undertake creative imitation in the later stage does IPR protection become an important element in technology transfer of industrial activities" (Kim, 2003).

Weak patents can help local firms in the early stages of industrialization to build their technological capabilities by permitting imitation and reverse engineering.

The strengthening and the expansion of patent protection do not seem to have stimulated innovation in developing countries so far. In Mexico, a study found no increase in domestic patenting after the substantial changes made to the patent law (1991), while a significant increase in foreign patenting was observed (Aboites, 2003). In the case of Brazil, in the period 1990–2001 only 27 patent applications were filed by domestic enterprises in the pharmaceutical sector — one of the most active in patenting worldwide — compared with 2,934 applications made by foreign companies (Elias, 2004).

The strengthening and the expansion of patent protection do not seem to have stimulated innovation in developing countries so far.

Another important consideration for the analysis of the role of IPRs in LDCs concerns the relationship between innovation and firm size: literature points to important asymmetries in the potential benefits of IPRs for small and large firms, even in developed countries — that is, patenting and enforcement of IPRs increase with firm size and the level of innovative activity (Curran and Blackburn, 2000). Studies on the relationship between patenting and firm size indicate that patenting is rare among SMEs, which prefer to protect their innovations through informal means such as trade secrets, trust and contracts (Curran and Blackburn, 2000; Correa, 2003). The findings from the case study in Bangladesh also corroborate the hypothesis that innovation varies with firm size (subsection D.3 of this chapter). Poor managerial capacity and skill level of workers, poor financing or lack of access to financial capital, poor support services, weak industrial and social infrastructure, a poor marketing and distribution network and a poor technological knowledge base make the use of innovation-related IPRs illusory for most SMEs in LDCs (Correa, 2003). In addition, obtaining patents and maintaining them in force is a very costly process. The acquisition of a patent is generally subject to a fee and requires costly legal advice on how to draft the specifications and claims appropriately. In many LDCs there are few, if any, patent attorneys. Even when a patent is obtained, the maintenance fees (that prevent the patent from lapsing) are largely unaffordable for most SMEs (Kitching and Blackburn, 1998).[25] Even more significant costs may be incurred in monitoring possible infringements and enforcing IPRs. Patent litigation may be extremely risky and expensive, especially if foreign grants have been obtained, and beyond the reach of most small and medium enterprises (SMEs).[26]

Historical experiences from a number of East Asian economies (Japan, Republic of Korea and Taiwan Province of China) demonstrate that systems with weak IP protection are better able to promote and facilitate incremental innovation, absorption and diffusion of technology, particularly in SMEs. Evidence from countries such as Brazil, the Philippines, Japan and Switzerland suggests similar findings. The Republic of Korea, for example, had almost no IP protection during the early stages of its industrialization (Amsden, 1989). The experience of late industrializers in Europe points to much the same conclusion (Chang, 2002).[27] Similarly, in the United States international copyright was not respected until the 1890s (Yu, 2007).

Historical experiences demonstrate that systems with weak IP protection are better able to promote and facilitate incremental innovation, absorption and diffusion of technology, particularly in SMEs.

2. Firm-level evidence

Mounting empirical evidence about the impact of IPR regimes on innovation, from studies that evaluated the reliance of the United States and European firms on IPRs as a method for acquiring better protection for their technical know-how, shows that firms prefer to rely on methods other than IPRs, such as trade secrecy and lead times, in protecting their intellectual assets.[28] The most important surveys of United States firms indicate that patents are not a very important tool for capturing the benefits of innovation (except in the pharmaceutical industry), although their impact varies between sectors. The pharmaceutical industry is one of the few sectors where patents are an important part of the inducement mechanisms. More recent empirical studies tend to confirm those earlier findings (Cohen, Nelson and Walsh, 2000; Scherer, 2005).

This type of evidence implies that an exclusive focus on patents as the solution to knowledge generation may be misplaced and that patents are only a small part of the "tool box" used to capture rents from innovation (Cowan and Harrison, 2001), except with regard to the pharmaceutical industry and some high-tech industries.

Exclusive focus on patents as the solution to knowledge generation may be misplaced and that patents are only a small part of the "tool box" used to capture rents from innovation.

Empirical evidence about the impact of IPRs in developing countries in general is scant and ambiguous (CIPR, 2002; UNCTAD and ICTSD, 2003a). A recent study on the impact of IPRs in Mexico found that they play no role in stimulating innovation in the maize-growing industry (Léger, 2005). Other studies from countries with lagging scientific and technological infrastructure suggest that IP protection has not been a significant determinant of growth (Maskus, 2005). The case study of 155 firms in Bangladesh finds that IPR protection, an inducement to innovation, is better suited to TNCs operating in Bangladesh (conducive to rent-seeking), than to technological learning and innovation in local LDC firms (Gehl Sampath, 2007a; subsection D.3 of this chapter).

Competition, rather than IPR-based monopoly, can be a powerful incentive for innovation, as is illustrated by the Indian semiconductors industry (Jensen and Webster, 2006). Other studies suggest that IPP is not usually the driving force behind R&D (Hart, 1994). In the area of software in particular, non-proprietary models such as "open source" schemes have been very effective in supporting a vibrant process of innovation.

In the area of software in particular, non-proprietary models such as "open source" schemes have been very effective in supporting a vibrant process of innovation.

3. Evidence from an LDC: The case of Bangladesh

Bangladesh, the country chosen for this study, is in many ways exceptional in the LDC category owing to its thriving domestic processing sector, which is actively engaged in exporting textiles and ready-made garments (RMGs), processed food products and generic drugs. For example, Bangladesh now exports a wide range

of pharmaceutical products (therapeutic class and dosage forms) to 67 countries. In order to evaluate the impact of IPRs on innovation in an LDC, an original in-depth study on the impact of intellectual property rights as an incentive to innovate in the domestic processing sector in Bangladesh was commissioned by UNCTAD and conducted by Padmashree Gehl Sampath between October 2006 and May 2007, for this Report (Gehl Sampath, 2007a). The study used both quantitative and qualitative techniques in order to explore the impact of intellectual property rights on three domestic processing sectors in Bangladesh: agro-processing, textiles and garments, and the pharmaceutical sector. The choice of sectors was prompted by their relative economic importance to the economy, the relative importance of IPRs and varying degrees of sectoral technological intensity. Both the agro-processing and textiles and garments sectors are low-technology, whereas the pharmaceutical sector is a patent-intensive, high- technology sector.

As a least developed country, Bangladesh is exempt from implementing the general provisions of the TRIPS Agreement until 2013, and has a further extension until 2016 for implementing its provisions on patents and clinical test data in the area of pharmaceutical products and related processes (in accordance with the Doha Declaration)...

The study had three main stages. In the first stage, a background report and a pilot survey on the state of innovation and the main incentives that play a role in driving innovation in the domestic processing sector were prepared jointly with a local research team in Bangladesh. The second stage consisted of 155 firm-level surveys using the data generated through the background report and pilot survey. A semi-structured questionnaire covering all three sectors was given to each firm. Of the firms surveyed, 50 were in the agro-processing sector, 60 were in the textiles and garments sector, and 45 were in the pharmaceutical sector. The third stage consisted of face-to-face interviews conducted with a cross-section of firms, as well as a variety of other actors, including leading professional associations, agencies and relevant government departments. Those interviews were used as case studies to interpret the results of the survey. More than 105 persons (including CEOs and top-level management) were interviewed for the study.

As a least developed country, Bangladesh is exempt from implementing the general provisions of the TRIPS Agreement until 2013, and has a further extension until 2016 for implementing its provisions on patents and clinical test data in the area of pharmaceutical products and related processes (in accordance with the Doha Declaration). However, the country is currently working towards gradual compliance with the TRIPS Agreement, and has a bilateral agreement with the EU to comply with its provisions before 2013. The EU–Bangladesh Commission is negotiating several aspects of the latter agreement, a part of which also provides that Bangladesh will make its intellectual property institutions TRIPS-compliant. The Bangladeshi Parliament is expected to amend the country's trademark, patent and copyright legislation, after a lengthy inter-agency approval and clearance process, in order to make it TRIPS-compliant.

... However, the country is currently working towards gradual compliance with the TRIPS Agreement, and has a bilateral agreement with the EU to comply with its provisions before 2013.

Bangladesh's knowledge infrastructure is very weak when judged by conventional indicators such as R&D investments as percentage of GDP, centres of excellence for basic and applied research in both the public and private sectors of the economy or scientists and researchers per million inhabitants (UNCTAD, 2006b; chapter Introduction of this Report, table 1). Therefore, the study defined innovation not in the strict sense of that term, but as the application of new practices and production of all products and process technologies that are new to the firms in question (Nelson and Rosenberg, 1993). Those incremental innovations ranged from small changes in process technologies that lead to significant improvements in production methods, to new organizational techniques that lead to improved delivery efficiency for existing products or to the production of new technologically improved products. Innovation was measured by the number of new product and process developments applied by the firms in the past five years.

The study analysed the process of learning and innovation in the three domestic processing sectors and the various factors that influence innovation in Bangladesh.[29] It considered a large range of firm-level factors and their impact on new product or process innovation in the three sectors, such as the contribution of scientific/skilled manpower, the quality of local infrastructure services for new product and/or process development, financial constraints and availability of venture capital, collaboration with local universities, local R&D institutes, intellectual property protection, participation in local SME development schemes, participation in government–firm technology transfer coordination councils, and the transfer of personnel between local firms or R&D institutions. It sought to measure both the direct impact of intellectual property rights on promoting R&D and enhancing the innovative performance of firms, and the indirect impact on innovative activities, in terms of technology transfer, licensing and technology sourcing through foreign subsidiaries.

The survey found no observable positive IPR impact on licensing, technology transfer or technology sourcing through foreign subsidiaries.

The survey covered large, medium-sized and small firms equally across all three sectors. A medium-sized firm employs between 300 and 500 workers in the textiles and garments sector and about 500 employees in the pharmaceutical sector. The agro-processing sector has a large number of very small home-based units (with fewer than 10 employees). In the textiles and garments sector, the survey covered specialized textile mills, ready-made garment firms and the traditional handloom sector (one of the oldest creative industries in the region). In the agro-processing sector, the focus was on the general food-processing industry, which uses, for example, spices, grains, cereal and flour to produce and market processed food products, as opposed to any specialized niche, such as shrimp farming or rice products. The pharmaceutical sector survey covered both indigenous pharmaceutical firms and subsidiaries of TNCs operating within Bangladesh.

(a) Innovation incentives and the role of intellectual property rights

Half of the agro-processing firms, 96 per cent of pharmaceutical firms and 55 per cent of textiles and RMG firms surveyed considered technology transfer from external sources, both public and private, to be of very little importance for new product/process innovations at the firm level.

Innovative capacity within local firms is very low across all three sectors. The study finds that the presence of intellectual property rights in the local context does not play a role either as a direct incentive for innovation or as an indirect incentive enabling knowledge spillovers (through various technology transfer mechanisms such as licensing, imports of equipment and government–firm technology transfer). Currently, intellectual property rights within the country are benefiting mostly TNCs operating in the local market, as the local firms are not sufficiently specialized to protect their innovations. IPRs in any case may not be appropriate for the types of incremental innovations in which most firms engage.

Table 26 contains a summary table of the survey, based on descriptive statistics on innovation, contribution of technology transfer to new product/process innovations and other potential indirect impacts of intellectual property rights on knowledge spillovers to local firms. It shows that a large number of local firms considered themselves to be involved in new product/process innovations. There was no observable positive IPR impact on licensing, technology transfer or technology sourcing through foreign subsidiaries. Half of the agro-processing firms, 96 per cent of pharmaceutical firms and 55 per cent of textiles and ready-made garments (RMG) firms surveyed considered various sources of technology transfer, both public and private, to be of very little importance for new product/process innovations at the firm level. Other benefits of IPR protection in the local context that are usually referred to in the general literature on the topic, such as licensing and technology sourcing through foreign subsidiaries, hardly play any role. Only 4 per cent of agro-processing firm, 2 per cent of pharmaceutical firms and 7 per cent of firms in the textiles and RMG sector considered IPR protection

Table 26. Innovation, sources of knowledge and indirect effects of IPRs at the firm level in Bangladesh

	Agro-processing		Pharmaceuticals		Textiles	
	Number	*% of firms*	*Number*	*% of firms*	*Number*	*% of firms*
New product development						
No	9	18.0	2	4.4	11	18.3
Yes	41	82.0	43	95.6	49	81.7
New process development						
No	10	20.0	31	68.9	6	10.0
Yes	40	80.0	14	31.1	54	90.0
Impact of various sources of knowledge on new product/process innovation						
Technology licensing[a]	1	2.0	1	2.2	2	3.3
Tech sourcing from foreign subsidiaries	1	2.0	0	0.0	2	3.3
Firm's own innovation efforts	18	36.0	7	15.6	25	41.7
Other sources[b]	30	60.0	37	82.2	31	51.7
Number of firms	**50**		**45**		**60**	

Source: Gehl Sampath (2007a) based on field survey, 2006–2007.

a Including through IP protection.

b "Other sources" was defined by the firms as mainly imitation and copying.

The only important sources of innovation at the firm level are attributable to firms' own indigenous innovation efforts and imitation and copying from others.

to be of any use. The only important sources of innovation at the firm level are attributable to firms' own indigenous innovation efforts, and imitation and copying from others (the "other sources" category in the table).

(b) Sector-specific results

Sector-specific inquiry aimed at identifying the main drivers for innovation at the firm level and whether IPRs play a direct or indirect role for innovation, substantiated the results of the analysis in the previous sections of the study. Table 27 contains descriptive statistics on several variables, such as government incentives and skilled manpower for new product/process development at the firm level across the three sectors. The values contained are the mean between 1 (very weak) and 5 (very strong); thus, any rating above 2.5 indicates that the variable is important for new product/process development at the firm level. The table shows that skilled manpower and good local infrastructure play a very important role as regards new product/process innovations. This validates the analysis in the previous sections of the study. Government incentives play an important role in respect of the textiles and RMG sector and the agro-processing sector, since both receive cash incentives for export performance. The table also shows that intellectual property protection does not play an important role as far as new product/process development is concerned.

Skilled manpower and good local infrastructure play a very important role as regards new product/process innovations. Government incentives play an important role in respect of the textiles and RMG sector and the agro-processing sector, since both receive cash incentives for export performance. Intellectual property protection does not play an important role as far as new product/process development is concerned.

Those explanatory variables were considered together with several other quantitative variables, such as employment and R&D investments, in order to estimate a bivariate probit model for a firm's incentives to engage in new product/process innovations. The dependent variable is a dummy variable which distinguishes innovative from non-innovative firms, on the basis of new product and process development efforts carried out over the last five years. For an independent variable to be included in the set of regressors, it has to be present in the three data sets, so that its effect across the three sectors can be compared and its effect in the pooled model assessed.[30]

In addition to separate models for each sector, a pooled model was estimated. The poolability of the slope coefficients, that is those associated with the exogenous explanatory variables, was tested using a Chow-type likelihood ratio test, and the null hypothesis was not rejected. The results are set out in table 28, and the pooled model with different sector intercepts is thus the more preferred model. The first

Table 27. Factors contributing to new product/process development in Bangladesh

Contribution to product development	Pharma biotech	Textiles & RMG	Agro-processing
Government incentives	1.066	2.754	2.980
Skilled manpower	2.493	3.100	3.540
Collaboration with univs.	1.177	2.435	2.520
Collaboration with DRIs	1.087	2.364	2.400
Intellectual property protection	1.219	2.000	2.280
Good local infrastructure	1.980	2.799	2.860
Venture capital	1.581	2.017	2.240
Local SMIs	1.131	2.029	2.200
Mobility of staff between public and private sector	1.444	2.137	2.420
Loom & dye tech. contrib.	-	2.398	-
Number of firms	**45**	**60**	**50**

Source: As for table 26.
Note: Figures in table represent the mean of rankings between 1 (very weak) and 5 (very strong).

three pairs of columns form the general model with different slope parameters, and the last pair of columns shows the more preferred restricted model (pooled data). The general model reported in the first three pairs of columns was first tested against an even broader general model where all the potential incentives for new product/process innovations at the firm level were considered, and the set of regressors included IPRs, intensity of collaboration, areas of government/other institution support, education of staff and level of training, and financial support constraint variables. It was found that those variables do not play any role with regard to the likelihood of their being involved in new product/process development in the three sectors in Bangladesh, and they were thus excluded from the model.

The results of the model can be interpreted as described below.

The results of the study indicate that the limited R&D that is being carried out in public research institutions is relatively removed from the needs of local production.

Firstly, the results of the study indicate that R&D expenditures, expressed as a percentage of total sales, play a negative role in both new product and new process development, as all three sectors mainly engage in very low-value-added activities, which are labour-intensive rather than R&D-intensive. The limited R&D that is being carried out is relatively removed from the needs of local production in all three sectors (see also UNCTAD, 2006b: chapter 6). The Government's current policies may even exacerbate this situation, as they are too narrowly focused on limited areas (promotion of exports and macroeconomic stabilization) and mainly favour urban, large and middle-sized private entrepreneurs. Consequently, public policies should be expanded to promote learning at the firm level, which would assist firms in their efforts to engage more in knowledge-intensive, value-added production and processing activities.

Public policies should be expanded to promote learning at the firm level, which would assist firms in their efforts to engage more in knowledge-intensive, value-added production and processing activities.

Secondly, larger firms (in terms of full-time employment) are less frequently involved in new product and new process development. That result can be explained by the fact that the data set is composed of a large number of small and medium-sized firms, (owing to the composition of the sectors, agro-processing and handloom production generally being small-scale). The smaller the firm is, the larger its relative R&D expenditure, and hence the result just mentioned.

Thirdly, intellectual property rights do not contribute to new product or process development in any of the three sectors (see also table 27). Most firms in the agro-processing sector did not believe that those rights played a major role either positively or negatively. They had major concerns about their impact on seed

Table 28. New product/process development in Bangladesh: Bivariate probit ML estimation results

Variable	Co-efficient	(Std. error)	Co-efficient	(Std. error)	Co-efficient	(Std. error)	Co-efficient	(Std. error)
	Agro-processing		*Pharma biotech*		*Textiles*		*Pooled data*	
New product development								
R&D intensity 2001–2005 (in log)	-0.169	(0.114)	0.072	(0.195)	-0.152**	(0.064)	-0.174***	(0.052)
Employment (FTEs in log) 2001–2005	-0.570**	(0.252)	0.000	(0.412)	-0.191	(0.121)	-0.294***	(0.099)
Collaboration with industry association	0.934	(0.793)	0.000 (assumed)		0.417	(0.446)	0.874***	(0.337)
Agro-processing	-	-	-	-	-	-	-2.414***	(0.548)
Textiles	-	-	-	-	-	-	-1.643***	(0.456)
Intercept	2.180	(1.588)	2.150	(3.005)	1.141	(0.974)	3.600***	(0.894)
New process development								
R&D intensity 2001–2005 (in log)	-0.219**	(0.089)	0.072	(0.195)	0.019	(0.108)	-0.115**	(0.053)
Employment (FTEs in log) 2001–2005	-0.336*	(0.180)	0.000	(0.412)	-0.703	(0.459)	-0.353***	(0.114)
Agro-processing	-	-	-	-	-	-	-2.317***	(0.521)
Textiles	-	-	-	-	-	-	-0.895**	(0.454)
Intercept	0.247	(1.191)	2.150	(3.005)	6.025	(3.944)	3.443***	(0.944)
Number of firms	50		45		60		155	
Log-likelihood	-17.095		-9.221		-26.947		-58.519	

Source: As for table 26.
Significance levels: * 10%; ** 5%; *** 1%.

availability and seed price. Larger firms tended to regard IPRs as more beneficial than did smaller firms, seeing them as a tool them which they could protect their products and secure economic benefits. Other firms, which considered IPRs to be detrimental to innovation, based their assessment on the indirect impact of IPRs on increasing prices of seeds and other inputs. However, at this stage it is difficult to assess with any conclusiveness the impact of rising seed prices on agricultural produce in Bangladesh resulting from application of IPRs. Most agro-processing firms do not produce agricultural inputs in-house, and the inefficiencies in post-harvest techniques and lack of organized sale of agricultural produce within the country do not permit a rigorous assessment of the impact of increased seed prices on agricultural produce.

In the textiles and RMG sector, most of the firms interviewed did not believe that IPRs played any role as an inducement to innovation, since they simply assembled the final output according to precisely given, buyer-determined specifications. Firms noted that that since they did not possess any indigenous design-related capabilities, IPRs could not be an inducement to innovation. Regarding whether they benefited from IPR protection in terms of increased collaboration with external firms, the general view was that the buyer firms did not help them in their efforts to upgrade technology or to enhance innovative capabilities since this would help them to create better backward linkages, especially in knitwear, and enhance the bargaining power of the local firms. Most local firms considered that such knowledge-sharing would be inimical to the interests of the buyer firms, which benefited from the low prices in the market due to the local firms' lack of bargaining power.

The firms in the pharmaceutical sector are mainly engaged in the formulation of active pharmaceutical ingredients (APIs), (requiring manufacturing skills only), and are striving to build capacity in order to engineer APIs (requiring knowledge-intensive chemical synthesis skills). Since foreign firms can obtain patents on their

products in the country, the local firms were concerned that this might adversely affect their efforts to venture into reverse engineering of APIs. The patents on pharmaceutical products (approximately 50 per cent of the 182 granted in 2006) are not on local innovations. This points to the existence of other reasons for patenting, such as strategic use, monopoly profits, and prevention of parallel imports (Gehl Sampath, 2007a). This issue, however, needs to be explored further. As regards the indirect impact of IPRs on firms' activities, most firms in the survey have been unsuccessfully engaged in negotiating technology transfer in order to increase their that API capacity, reverse engineering skills and other such know-how. However, even those firms that have been successful in negotiating agreements with foreign firms considered that IPRs were not a helpful factor in promoting foreign collaboration for access to technology.

Firms that collaborate closely with industry associations are more likely to engage in new product development.

Fourthly, firms that collaborate closely with industry associations are more likely to engage in new product development; however, the variable "collaboration with industry association" plays no role in new process development. That finding is consistent with the study's analysis, which indicates that firms mainly seek support and lobby for policy change through professional associations, so as to make up for the absence of an institutional and policy framework that could stimulate and support innovation. Finally, ceteris paribus, firms in the agro-processing and textiles sectors are less frequently involved in new product and new process development than those in the pharmaceutical sector. Maximum-value-addition activities are currently taking place in the pharmaceutical sector. The textiles and RMG sector, although a high foreign exchange earner, has relatively lower value-addition capacity.

Lack of engineering and scientific skills and public support for technological upgrading constitutes a significant barrier to learning. Strategic policy support that strengthens the absorptive capacity of firms, and enables them to move from labour-intensive to knowledge-intensive activities, is urgently needed.

As already mentioned, the broader general model where all the potential incentives for new product/process innovations at the firm level were considered, including IPRs, intensity of collaboration, areas of government/other institution support, education of staff and level of training, and financial support constraint variables, showed that such variables do not play any role with regard to the likelihood of their being involved in new product/process development in the three sectors in Bangladesh. That points to one of the most critical issues facing all three sectors equally: the underdeveloped state of the domestic knowledge system as a whole and firms' low absorptive capacity. As noted above, the lack of engineering and scientific skills and public support for technological upgrading constitutes a significant barrier to learning. Strategic policy support that strengthens the absorptive capacity of firms, and enables them to move from labour-intensive to knowledge-intensive activities, is urgently needed to remedy that constraint on enhanced sectoral competitiveness.

More concerted policy effort is required to promote the build-up of processing capacity in the pharmaceutical sector in Bangladesh.

In the agricultural sector, more research that meets the needs of the agro-processing sector needs to be conducted, including adaptive research on enhancing variety and ensuring the availability of fruit and vegetables all year round, as well as livestock research, according to field interviews. The scope of the New Agriculture Extension Policy, which focuses mainly on extension services for cereal crops, needs to be broadened in order to benefit the agro-processing sector. Most importantly, there is a need for inclusive policy action that also caters to the needs of the majority of the rural agro-processing firms. Similarly, the survey indicates that more concerted policy effort is required to promote the build-up of API capacity in Bangladesh. Such policy responses extend beyond property rights. Strategic policy action is needed in order to improve the impact and conduct of public sector research in universities and public research institutes in particular, so as to upgrade technologically, as required in the globally competitive pharmaceutical sector. Similarly, low value-addition capacity in the textiles and RMG sector emphasizes the need for policy support institutions. For

all three sectors, the lack of government support to subsidize learning is a problem that should be addressed in the near future. Creation of human resources at the secondary and tertiary levels should be targeted. Policy incentives are required in order to translate individual capabilities into organizational capabilities so that human resources currently available in the three sectors can be harnessed appropriately.

Policy incentives are required in order to translate individual capabilities into organizational capabilities so that human resources currently available in the three sectors can be harnessed appropriately.

Table 29 contains the survey firms' rankings in critical areas of support for engaging in more knowledge-intensive activities. The figures present the mean of rankings between 1 (least important) and 5 (most important). As the table shows, firms across all three sectors consider policy support to be critical in several areas, including science and technology support institutions, testing and quality evaluation facilities, and financial support.

(c) Summary of key findings

This study has conducted an in-depth investigation of innovation and competitiveness in three sectors of domestic processing in Bangladesh: the agro-processing, the textile and RMG and the pharmaceutical sectors. The objective was to evaluate the relative importance of IPRs as a firm-level incentive. The findings seek to contribute to the growing literature on intellectual property rights and development, and also make the case for broadening the discourse on the nature of knowledge and learning activities in LDCs beyond IPRs.

Innovative capacity within local firms remains very low across all three sectors. The survey finds that the presence of intellectual property rights in the local context does not play a role either as a direct incentive for innovation or as an indirect incentive enabling knowledge spillovers (through various technology transfer mechanisms such as licensing, imports of equipment or government–firm technology transfer). At the present time, intellectual property rights are benefiting mostly the TNCs operating in the local market, as local firms are not sufficiently specialized to protect their innovations under the current IPR regime. This regime in any case may not be appropriate for the types of incremental innovations in which most firms engage. The majority of local firms considered themselves to be involved in new product/process innovations; however, there was no observable positive IPR impact on licensing, technology transfer or technology sourcing through foreign subsidiaries. Over half of the agro-processing firms, and of the textiles and RMG firms (55 per cent in both cases) and the great majority of pharmaceutical firms surveyed (96 per cent) considered technology transfer from

The survey finds that the presence of intellectual property rights in the local context does not play a role either as a direct incentive for innovation or as an indirect incentive enabling knowledge spillovers (through various technology transfer mechanisms such as licensing, imports of equipment or government–firm technology transfer).

Table 29. Areas of policy support for enhancing the innovative performance of firms

Areas of policy support for innovative performance	Pharma Biotech	Textiles & RMG	Agro-Processing
Science and technology support institutions	3.734	3.651	3.940
Testing and quality evaluation facilities	4.179	3.785	3.620
Professional associations	-	4.584	3.500
Market research and intelligence	4.023	4.232	3.400
Overseas market promotion	4.178	3.685	3.280
Export credit program	2.890	3.284	3.420
Financial incentives	4.176	3.850	3.320
SME support	1.419	2.931	2.960
Number of firms	45	60	50

Source: As for table 26.

Note: Figures in table represent the mean of rankings between 1 (very weak) to 5 (very strong).

external sources, whether public or private, to be of very little importance for new product/process innovations. Only a small number (4 per cent) of agro-processing firms, 2 per cent of pharmaceuticals firms and 7 per cent of firms in the textiles and RMG sector considered IPR protection to be of any use. The only important sources of innovation at the firm level are the firms' own indigenous innovation efforts and innovation through imitation and or copying.

The overall finding is that IPRs are equally unimportant across the three sectors, largely owing to domestic firms' inability to engage in knowledge-intensive activities.

The firms in the pharmaceutical sector were very concerned that since foreign firms could obtain patents on their products in the country, this might adversely affect their efforts to venture into reverse engineering of APIs. As regards the indirect impact of IPRs on firms, most firms surveyed have been unsuccessfully engaged in the process of negotiating technology transfer in order to increase API production capacity, reverse engineering skills and other such know-how. Even those that have been successful in negotiating agreements with foreign firms considered that IPRs were not a helpful factor in promoting foreign collaboration for access to technology.

The domestic knowledge system is very weak in Bangladesh, characterized by weak industrial and scientific infrastructure, poor collaboration and sectoral interlinkages, and lack of skills and institutional support for technological upgrading. In that context, the study finds that the relative importance of IPRs for domestic processing sectors of varying technological intensity, as expected (on the basis of the experience in developed economies, and as indicated by economic literature), may not hold for LDCs. The overall finding is that IPRs are equally unimportant across the three sectors, largely owing to domestic firms' inability to engage in knowledge-intensive activities.

The findings indicate that without proactive and strategic public policy in support of learning and innovation, the granting of IPRs does not generate higher levels of technological learning in domestic processing firms in Bangladesh.

In conclusion, the findings indicate that policy matters in reducing the collateral damage that occurs when nascent sectors in LDCs are exposed to global competition. Coherent national policies that focus strategically on enabling innovation in the three sectors will play a key role in transforming those sectors into more competitive modes and enable local firms to deal with any harmful effects of IP protection. Furthermore, the findings indicate that without proactive and strategic public policy, in support of learning and innovation, the granting of IPRs does not generate higher levels of technological learning in domestic processing firms in Bangladesh (Gehl Sampath, 2007a).

E. IPR regimes and LDCs: Policy implications

As knowledge becomes an increasingly important productive asset in today's globalizing world, IP will play a more and more prominent role in the organizing of economic activity.

As knowledge becomes an increasingly important productive asset in today's globalizing world, IP will play a more and more prominent role in the organizing of economic activity. But that role is not necessarily "development-neutral". Indeed, expanded IPP is associated with the proliferation of legal monopolies and related barriers to entry, which makes it harder for developing countries to compete in innovation-based markets. In today's knowledge-intensive global economy, those trends are accentuating the asymmetrical economic processes stacked against weaker participants.[31]

The expected beneficial impacts of change in policy regimes are predicated on the notion that knowledge is the same as information and is a transferable commodity. However, contrary to conventional wisdom, technical change, learning, innovation and knowledge accumulation are endogenous processes — that is, knowledge is not a downloadable commodity. Previously, there had been some hope that the combined effect of globalization and ICTs would be a powerful driver and facilitate the process of development strategies based on

catching up. Indeed, as the relevant data suggest, knowledge-based research and innovation activities (e.g. R&D, patents, licences and publications) are more unevenly distributed between the developed and developing countries than before; indeed, despite ICTs and stronger IPRs, there are clear signs of an increasing knowledge and technology divide (Johnson and Segura-Bonila, 2001; UNIDO, 2006).

Technical change, learning, innovation and knowledge accumulation are endogenous processes — that is, knowledge is not a downloadable commodity.

Equating "information" with "knowledge" may be the reason for exaggerated expectations regarding IPRs. But tacit knowledge cannot be transferred: it can occur only through the time-consuming process of interactive learning, learning by doing and learning by using. Furthermore, both tacitness and codification of knowledge is an obstacle to easy knowledge absorption, because of global knowledge asymmetries and "context specificities" that characterize knowledge. Knowledge is context-specific; it is socially and culturally embedded and dependent on the level of research and absorptive capacity in the recipient countries. Successful knowledge transfer presupposes the existence of domestic knowledge systems (i.e. a pro-innovation policy framework, infrastructure and appropriate institutional development, producer competence and learning, imitative capabilities and innovation capabilities at the firm level). The findings of the case study in Bangladesh corroborate the view that the local policy framework and a strategic vision have a critical role to play in the learning process (Gehl Sampath, 2007a).

The current pattern of IPP has undermined many countries' short- and medium-term technological learning prospects.

Most LDCs do not yet have the above discussed prerequisites in place (UNCTAD, 2006b: chapter 6). Without an adequate knowledge infrastructure and institutional framework to capture the potential benefits of new ideas and information, the benefits claimed for IPR-induced technology transfer are not likely to be forthcoming. Effective absorption of imported technologies crucially depends on the learning capacity of the recipient firms. A growing body of research suggests that the promised benefits of harmonized IPR regimes — leading to increased (external) knowledge flows and enhanced innovation, leading in turn to income convergence and poverty reduction — have largely bypassed most LDCs. Indeed, the current pattern of IPP has undermined many countries' short- and medium-term technological learning prospects. While TRIPS-based knowledge governance has provided a degree of confidence for foreign investors, in many LDCs this has been accompanied by sluggish domestic investment performance and a decline in their domestic technological performance. The expectation that property rights alone, without improvements in the wider knowledge ecology, would enhance their catch-up growth strategies has generally not been fulfilled. What is still missing is a credible relationship between incentives and outcome.

Throughout history, a stronger IP system has tended to be the result of technological development rather than its precondition.

Throughout history, a stronger IP system has tended to be the result of technological development rather than its precondition. Available evidence suggests that stronger patent rights are likely to increase payments from developing to developed countries without having a favourable impact on domestic technological capacity. And while FDI may strengthen patent rights in middle-income and large developing countries, this is not the case in the poorest ones. This is confirmed by the case study of 155 firms in the domestic processing sector in Bangladesh (with the exception of the pharmaceutical sector as a whole, which is dominated by TNCs). The findings of the Bangladesh case study indicate that IPR policies are not considered to be of particular importance to local firms in LDCs, which are not yet capable of innovation in the strict sense of that term (subsection D.3). Rather, low-income countries should focus on strengthening their absorptive and learning capacities, enhance the efficacy of their domestic knowledge systems and improve their knowledge ecology.

The TRIPS-based regulatory framework has transformed the conditions for learning in LDCs (most of which did not even have IP legislation prior to the adoption of the TRIPS Agreement, and many still do not) and unduly focused the attention of policymakers on the harmonization of IPP with what already exists in the advanced countries, but "the appropriate intellectual property regime for a developing country is different from that for an advanced industrial country"(Stiglitz, 2005: 2).

Low-income countries should focus on strengthening their absorptive and learning capacities, enhance the efficacy of their domestic knowledge systems and improve their knowledge ecology.

IPRs provide an incentive to innovate, but like any other incentive, it works only in certain contexts (Scotchmer, 2004). IPRs are not a magic tool that can boost innovation without other essentials, such as a critical level of skills, information, capital and markets.[32] Generally, it seems clear that patents stimulate innovation only marginally, if at all, in countries with weak scientific and technological infrastructure (at the initiation stage of technological learning). As the findings of the Bangladesh case study indicate, IPRs play no role in stimulating innovation in the textiles and garments and food processing sectors.

IPRs are unlikely to play a significant role in promoting local learning and innovation in countries with low absorptive capabilities in the "initiation" phase, which is marked by an absence of the basic conditions for patents to operate as incentives for innovations, namely high R&D investments and capacity for reverse engineering and low-cost production (Foray, 2004). In the second, "internalization", stage, local firms can learn through imitation under a flexible IPR regime, while technology owners face a growing risk of imitation, and tensions between domestic and foreign firms increase. It is only in the third stage — the "generation" stage — that local innovative firms in the most dynamic sectors can fully benefit from intellectual property protection (Kim, 2003).[33]

The TRIPS-based regulatory framework has transformed the conditions for learning in LDCs and unduly focused the attention of policymakers on the harmonization of IPP with what already exists in the advanced countries.

Even if, under certain conditions, IPRs were to positively encourage technology transfer through licensing, LDCs are unlikely to become significant recipients of licensed technology. The low technical capacity of local enterprises constrains their ability to license in technology, while the low GDP per capita in LDCs is not likely to stimulate potential transferors to engage in such arrangements (Yang and Maskus, 2005; section E of chapter of this Report).

In that context, any policies directed at increasing the transfer and dissemination of technologies should be actively supplemented by complementary measures aimed at strengthening firms' capacity to effectively absorb new knowledge through adaptation and knowledge expansion throughout society.

Licensing, as a channel for technology transfer, is also likely to be of little importance to firms in LDCs, as IPRs, particularly patents, promote innovation in profitable markets only where firms have the required capital, human resources and managerial capabilities. Similarly, licensing is out of reach for firms without a critical level of absorptive capacity. However, only in the "generation" stage of technological development can the benefits of IPRs offset the costs and constraints imposed on domestic research and production capacities.

The appropriate intellectual property regime for a developing country is different from that for an advanced industrial country.

For LDCs, improving their knowledge ecology, namely the institutional framework that creates the capacity to access, produce and use knowledge throughout the economy, will require far more than IP protection. The process of knowledge transfer is complex, costly and time-consuming. Advocates of strong IP protection tend to underestimate the difficulties involved in learning and in the knowledge-transfer process. The standard assertion that thanks to strong IPRs, knowledge can now travel freely and cheaply between countries is simply not realistic, as it disregards the complex dynamics of knowledge governance. Available evidence indicates that the expectation that more stringent levels of IP

protection will necessarily stimulate learning has not been met, as illustrated by the case study in Bangladesh (subsection D.3).

The current transformation of the international IPR system exhibits inherent market failures which are not Pareto optimal, insofar as (i) it increases the "excludability" of R&D results and reduces knowledge diffusion and informational spillovers; and (ii) by focusing on licensing and patenting as the salient mechanism of technology transfer, the IPR regime imposes incentives that threaten to crowd out other (superior) mechanisms. Another cause for concern is that the diversity of institutional arrangements is threatened. The post-TRIPS perspective that IPRs are the only means of valorizing intangible capital, and should therefore be the commonly used yardstick for the pricing of knowledge and ideas, is questionable.

The space for public research and knowledge-sharing is shrinking: functions that were previously assumed to be in the public domain can no longer be so assumed, owing to a growing trend toward commoditization of publicly-funded research outputs, including of data and information resources.

The space for public research and knowledge-sharing is shrinking: functions that were previously assumed to be in the public domain can no longer be so assumed, owing to a growing trend toward commoditization of publicly-funded research outputs, including of data and information resources (David, 2006d; Okediji, 2004, 2006; Nelson, 2004). No longer is it safe to assume that publicly funded research will be distributed freely. Privatized or restricted information flows will inevitably slow down developing countries' learning capacities and pace of innovation; this will make it more difficult to improve on existing technologies and products, and thus slow down the process of technological upgrading (Sampat, 2003). Since technologies in the public domain can play an important role in the development of productive capacities in LDCs, restricting access to the existing pool of knowledge in the public domain, via strong IPRs, may hinder those countries' learning potential. The shrinking of the public domain can only exert an adverse impact on the LDCs' learning trajectories.

Developing country firms largely rely on informal learning mechanisms, such as imports of capital goods and equipment, imitation and reverse engineering, as important mechanisms for knowledge access and learning. That fact is confirmed by the findings from the case study in Bangladesh (subsection D.3). This implies that if an LDC is seeking to attract more FDI or promote entrepreneurial activities at home, it should address constraints related to efficient knowledge governance, growth and technology infrastructure before dealing with IPR issues. The relevant policy question is to ask at what stage of development, economic and market-based incentives (such as patents) start to "kick in". Furthermore, a stronger patent system may create new problems for LDCs as it tends to increase the adverse effect of excessive IPRs elsewhere. In a globalised economy, the strengthening of IP protection in economies that are rapidly catching up may even create negative externalities for LDCs, thereby slowing down their catch-up growth processes.[34]

Restricting access to the existing pool of knowledge in the public domain, via strong IPRs, may hinder those countries' learning potential. The shrinking of the public domain can only exert an adverse impact on the LDCs' learning trajectories.

In addition, owing to increased copyright protection (life plus 50 years), information flows are constricted more generally. Access to copyrighted materials has become more limited, as has the right to make reproductions for educational purposes. That may have an adverse impact on access to copyrighted works for education, research and knowledge diffusion in general. Although the TRIPS Agreement allows some degree of unauthorized copying via the "fair dealing" exception, these exceptions are increasingly being eroded via technological protection measures (TPMs) or digital rights management systems used to control access to or use of their marks by authorized users. That implies that the application of stringent IP standards may impede access to textbooks, journals and other educational material in poor countries by requiring the consent of, and likely payment to, the IPR holders prior to copying (CIPR, 2002). Experts are even more concerned about its impact on the Internet, which, despite its enormous potential for broadening access to education and knowledge dissemination in

poor countries, can be constrained via application of encryption technologies that can override the principle of fair use or fair dealing by making every exception or limitation subject to the "three step test" (TRIPS Article 13). The principle of fair use needs to be preserved in cyberspace through both national and international regulation (Okediji, 2001, 2006).

1. One size does not fit all and the need for flexibility in IPR systems

The fact that the costs and benefits of a stronger IPR system are unequally distributed between the users and producers of knowledge, and that the low-income countries are likely to bear high costs without receiving much benefit in return (at least in the short and mid-term), creates a strong case for adapting the system to the particular country context. Given the countries' heterogeneities and the differences in their knowledge ecologies, the one-size-fits-all principle is suboptimal (CIPR, 2002). Avoiding general solutions to IPR management is recommended. The poorest nations clearly need flexibility as well as ad hoc mechanisms to build a sound and viable technological base.

The costs and benefits of a stronger IPR system are unequally distributed between the users and producers of knowledge, and low-income countries are likely to bear high costs without receiving much benefit in return.

2. What kind of technical assistance is needed?

Serious concerns have been expressed that the type of technical assistance provided to LDCs so far has not met the requirement contained in Article 66.2.,[35] namely that "[d]eveloped country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least developed country Members in order to enable them to create a sound and viable technological base". To date, the technical assistance provided to LDCs has focused on designing and implementing IPR legislation consistent with the TRIPS Agreement, and not on their needs with regard to building "a sound and viable technological base". As such, it responds far more to the interests of IP rights holders than to the fundamental development concerns of LDCs (Correa, 2007; Kostecki, 2006).

To date, the technical assistance provided to LDCs has focused on designing and implementing IPR legislation consistent with the TRIPS Agreement, and not on their needs with regard to building "a sound and viable technological base".

F. Alternative knowledge governance models

Given the social inefficiencies inherent in the post-TRIPS IP regime, related to excessive privatization and commoditization of knowledge, the challenge in the policy design of alternative mechanisms is how best to address the dilemma of the knowledge trade-off — that is, how to simultaneously support and encourage increased knowledge access, production and use? What is the design of "superior" solutions to the knowledge trade-off dilemma associated with proprietary models? How to preserve access to essential technological knowledge that can contribute to incremental improvements, local innovations and capacity-building, and how to best create conditions for effective knowledge governance? What kind of catching-up mechanisms could substitute for imitation? Which new policy mechanisms can better meet the objectives of simultaneously encouraging and supporting the production of new knowledge while facilitating broad and rapid access to new knowledge? Logically, solutions will depend on the nature of knowledge and the cost structure of the markets for ideas (Johnson, 2005).

Providing broad and immediate access to information is important for two kinds of knowledge: essential knowledge for passive consumption (such as new molecules and compounds that enable the production of new drugs or vaccines); and cumulative knowledge or knowledge as productive capital (for active use),

such as new information technologies that would enable incremental innovation and new applications in traditional sectors (Machlup, 1983; Foray, 2000, 2007).

Five sets of "solutions" for alternative policy designs are proposed: they relate both to improving the efficiency of the global IPR system (proprietary solutions) and to the use of non-IP mechanisms (non-proprietary solutions).

1. The first set of solutions deals with the improvement of the patent system itself at a global level, which may be a necessary (but not sufficient) condition for LDCs to benefit from a fully harmonized IPR system (i.e. calibration of standards and norms for countries at varying levels of development).
2. The second set involves using fully the internal flexibility offered by TRIPS to extend exclusion rights. The key issue is providing countries with the capacity to fine-tune their system in line with their needs and conditions, including via: (i) limitation on exclusion rights (exceptions and compulsory licensing); (ii) limitation on exclusion rights in terms of subject matter; and (iii) inclusion of new subject matters (e.g. traditional knowledge) in the international policy agenda.
3. The third set is related to the use TRIPS' external flexibilities, which consist of using the power of legal and regulatory institutions to reconstruct the research and information commons and support open source initiatives as a way of mitigating the adverse effects of the highly protectionist IPR environment by promoting the low-cost research and innovation model in LDCs.
4. The fourth set does not involve the direct manipulation of legal tools but is aimed at avoiding monopoly price distortions associated with IPRs (patent buy-outs and creation of incentives for price discrimination).
5. The fifth set of solutions is related to increasing R&D incentives in the area of neglected needs (public–private partnerships, advance purchase commitments).

Perhaps the most promising model for LDCs is offered by the open source mechanism.

The open source option involves a fast collaborative and incremental process, operating without patents but in a legally structured environment.

Perhaps the most promising model for LDCs is offered by the open source mechanism, associated with the new knowledge economy paradigm. A shift in the nature of the innovation process is currently taking place in the most developed innovation systems (Von Hippel, 2005). The open source option involves a fast collaborative and incremental process, operating without patents but in a legally structured environment. The mechanism is mainly based on voluntary contributions of innovators to solve a problem collectively and then share it openly. While such models are not new, the Internet has greatly increased their productivity. As a result, this model has been widely diffused in many fields, such as software, biomedical technologies and consumer products, as illustrated by unprecedented incremental rates of innovation in software development, where high rates of innovation are correlated with rich information spillovers. The open nature of these projects emphasizes collaboration, lack of price-based competition and collective efficiency. Unrestricted access to innovation and release of data, codes, information and knowledge, all in the public domain, support incremental and cumulative innovation. This method of innovation has proved to be particularly efficient in supporting incremental and cumulative innovation. The essence of the model is the accumulation of small inventive steps, which are shared within a community and form a collective invention. Open Source software also operates in a legal environment, using, inter alia, GPL (General Public License) or "copyleft" license; other models use Community Source License Agreements (used by Sun Microsystems), etc.

The objective of open source models is to create information and knowledge commons with important welfare implications in terms of: (i) no deadweight loss from above-marginal-cost pricing (directly associated with IPRs); and (ii) a built-in mechanism for price reduction, thereby increasing social welfare. In open source models, competition is based largely on the quality of post-product service rather than in the product development stage. Market entry costs are lower as entry is immediate; since innovation is shared; fixed costs of product development are significantly lower than in proprietary (IP) models. For innovators to be motivated to produce knowledge, there is no need for strong "rights to exclude", for exclusivity is not required in order to capture economic returns. Moreover, the model benefits from scale and network effects, as researchers and developers share new knowledge with their counterparts outside their own laboratories and firms. Access, production and use of new knowledge are achieved without the high social costs and inefficiencies associated with traditional proprietary models. This model is particularly applicable to LDCs because of its cost advantages and greater possibilities for learning thanks to the willingness of the innovators to share knowledge and ideas (David, 2005; Ghosh and Schmidt, 2006).

Fully exploiting the scope of TRIPS flexibilities is a crucial issue linked to the issue of the technical capabilities to use the opportunities offered by the system.

Other non-IP-based incentive mechanisms include: (i) subsidizing research (provision of funding for R&D through grants, tax credits, and work in government laboratories); (ii) developing prizes; and (iii) trade secrets. Additionally, other mechanisms that should be considered include: (i) legal provisions to stimulate firms to implement multipart pricing (Lanjouw, 2002); (ii) compulsory licensing; (iii) patent buy-outs (Kremer, 1998); (iv) advanced purchase commitments (Kremer); (v) public–private partnerships (Moran, 2005); (vi) information commons and open source initiatives (Maurer, 2003; Lessig, 2004; Nelson, 2005; David, 2005);[36] and (vii) compensatory liability regime ("use and pay system") (Reichman and Lewis, 2005).

1. Learning to use flexibilities: The role of national and regional IP offices

Fully exploiting the scope of TRIPS flexibilities (limitations, exceptions or extensions, such as compulsory licensing, fair use or fair dealing and parallel imports) is a crucial issue linked to the issue of the technical capabilities to use the opportunities offered by the system. The institutional capacity of national IP offices is critical, since those mechanisms are difficult to implement; sophisticated knowledge and competences in law and international agreements may therefore be required.

It is essential that national patent offices build their legal competences for using those mechanisms more effectively; the considerable flexibility offered by TRIPS would then be better exploited by LDCs.

That is why a TRIPS provision involves the obligation for the developed countries to provide technical assistance to the LDCs (Article 67). It is also essential that the national patent offices build their legal competences for using those mechanisms more effectively; the considerable flexibility offered by TRIPS would then be better exploited by LDCs.

In contrast to patent protection, the costs incurred and the time spent by competitors in IP protection under trade secrets has no acquisition costs, while overcoming the secrecy barrier through legitimate reverse engineering may in some cases be substantial. Trade secret protection, however, may not be a valid option when the technology can be easily traced from a product put on the market. Additionally, enforcement of trade secrets may impose significant procedural burdens.

2. Utility models

Utility models have been implemented in a large number of developed and developing countries.[37] Box 6 summarizes the differences between utility models and patents.

Utility models are essentially suited to protecting "minor" or incremental innovations and can be acquired more easily and at lower cost than patents. In all countries where utility models are recognized, the great majority of applications and grants are in respect of domestic applicants, in contrast with patents, where foreign applicants largely dominate, particularly in developing countries.

In addition to the traditional channels of technology transfer and dissemination, alternative means and mechanisms, such as joint research, country-level technology-sharing consortia, patent pools and technology-sharing consortia at the regional level, could be explored.

The extent to which a system of utility models may be useful in LDCs is debatable. Given the low level of development of manufacturing activities in LDCs, it is unclear whether there is a sufficient flow of (minor) innovations that can be captured by the system. Also, it is unclear whether the availability of utility models protection will necessarily encourage such innovations. However, as most LDC firms rely on mature technologies and imported machinery and equipment, it is unlikely that at this stage utility models could be of great value to them, but this could change as their technological capacity is upgraded. Utility models protection seems, in any case, a better starting point than patents.

In addition to the traditional channels of technology transfer and dissemination, alternative means and mechanisms, such as joint research, country-level technology-sharing consortia, patent pools and technology-sharing consortia at the regional level, could be explored.

Joint research initiatives involving various firms and research institutions may enable LDCs to put together the human and financial resources needed to undertake well-defined projects. Significant efforts should be made, however, to overcome the lack of an innovation culture and to build up the required inter-firm and inter-institutional trust and operational methods. The role of "bridging institutions", such as financial entities, specialized NGOs, business and farmers' associations, and public extension and technology support services, would be crucial for linking possible partners and helping them to define common objectives and procedures (UNCTAD, 2006b).

Transfer and dissemination of technology could also be boosted through country-level technology-sharing consortia. Members of the consortia that receive technology from one or more suppliers may mutually support absorptive efforts and reduce the costs of incorporation of new technologies.[38] As in the case of joint research initiatives, a great deal of collaboration by bridging institutions

Box 6. Utility models and patents

- The requirements for acquiring a utility model are less stringent than for patents. While the requirement of "novelty" has always to be met, that of "inventive step" or "non-obviousness" may be much lower or absent altogether. In practice, protection for utility models is often sought for innovations of a rather incremental character which may not meet the patentability criteria.
- The term of protection for utility models is shorter than for patents and varies from country to country (usually between 7 and 10 years without the possibility of extension or renewal).
- In most countries where utility model protection is available, patent offices do not examine applications as to substance prior to registration. This means that the registration process is often significantly simpler and faster, taking, on average, six months.
- Utility models are much cheaper to obtain and to maintain.
- In some countries, utility model protection can be obtained only for certain fields of technology, and for products but not processes.

Source: WIPO at www.wipo.org/sme/en/ip_business/utility_models/.

would be necessary for setting up consortia among firms with low technological development.

Patent pools organized by technology suppliers in particular fields may also help to provide access to required technologies, where the latter are protected under patents. A patent pool is an agreement between two or more patent owners to license (one or more) of their patents to (one or more) third parties. The benefit accruing to LDCs from patent pools would require the agreement of patent owners to license their technologies free or at a pre-determined royalty rate. Patent pools can reduce transaction costs, as individual negotiations are avoided. Given that LDCs' markets represent a tiny portion of global markets, licensing conditions under patent pools could encourage exporting in order to enable potential licensees to exploit economies of scale from external markets.

Inter-firm cooperation, via joint research, technology-sharing consortia or other modalities, at the national and regional levels can offer up-to-date technologies, access to markets and other learning advantages.

The generally accepted view is that joint ventures offer greater opportunities for the transfer of technology than do other modalities of firm governance, since domestic partners share in the ownership and management of the enterprise that receive new technologies. There may be inter-firm cooperation, via joint research, technology-sharing consortia or other modalities, at the national and regional levels, although firms tend to prefer linkages with companies in more advanced countries that can offer up-to-date technologies, access to markets and other learning advantages, rather than to link up with firms at the same level of knowledge. Monitoring technologies in the public domain is an important source of learning for LDCs; therefore, restrictions on this option will curtail their options and learning possibilities.

While our discussion is by no means exhaustive, it suggests that in addition to IPP, a panoply of tools and mechanisms exists, many of which are already being used successfully in other developing countries to enhance knowledge governance. Policymakers in LDCs, in collaboration with their international development partners, would be well advised to explore those alternatives.

In addition to IPP, a panoply of tools and mechanisms exists, many of which are already being used successfully in other developing countries to enhance knowledge governance, which policymakers in LDCs, in collaboration with their international development partners, would be well advised to explore.

G. Conclusions and recommendations for improving knowledge governance

The 1994 TRIPS Agreement initiated a move towards minimum global standards on patentable subject matters with far-reaching implications for the catch-up growth strategy of LDCs. In the context of the single undertaking of the Uruguay Round, developing countries, including the LDCs, undertook to align large parts of their IP legislation with the legislation of the major industrial economies in the hope that greater intellectual property protection would lead to more innovation and increased technology transfer. However, the expectation that this would yield higher rates of technology transfer, FDI and innovation has not been met. The relationship between strong IP protection and development is not straightforward; the impact of strong IP protection depends on a country's knowledge ecology (the institutional framework that enables access to, and production and use of, knowledge for learning and innovation) and the level of its technological absorptive capacity, or the ability of a firm to recognize the value of new, external information, assimilate that information and apply it to commercial ends. Strong IP protection may induce FDI and innovation in countries with developed knowledge systems; however, in economies with weak domestic knowledge systems, as is the case in all LDCs, strong IP protection limits policy options and may even be negative, if associated with increased prices for inputs and restricted opportunities for imitation. Despite a differential sectoral

impact, those findings are corroborated by the case study of the impact of IPRs on innovation in the domestic processing sector in Bangladesh (subsection D.3).

The knowledge systems in the LDCs are very weak. Initiating a sustainable process of knowledge governance that could accelerate the development of productive capacities in those countries is a daunting task, but not an impossible one. Several initiatives proposed in this Report may alleviate the constraints faced by LDCs so that they can better integrate into the global knowledge economy. Such initiatives crucially depend on the learning capacity to upgrade the capabilities of different domestic actors, with a large input of development-oriented technical assistance and foreign cooperation.

In economies with weak domestic knowledge systems, as is the case in all LDCs, strong IP protection limits policy options and may even be negative, if associated with increased prices for inputs and restricted opportunities for imitation.

The enterprise is the locus where technology learning and innovation take place. Any process of technological upgrading is inconceivable without the strengthening of entrepreneurial capacity, but this cannot be achieved via technology policies alone. Even in the absence of restrictions on accessing knowledge, no policy initiative, no matter how well designed, will catalyse learning until local firms begin to acquire the financial, managerial and technological capabilities necessary for incorporating new technologies and innovating accordingly. This process also requires institutions to provide technical support and establish linkages between local participants and external knowledge sources, e.g. technology providers, research partners, FDI partners, public and private R&D institutions, Internet content providers, other firms, educational and research institutions, NGOs, academic institutions, business associations and specialized technology institutions. Therefore, complementary institutional and organizational innovations need to dovetail with the learning process in order to enhance the technological absorptive capacities of the countries concerned.

A number of thorny issues arise with respect to the role of IPRs in the LDCs. Economists have found it extremely hard to measure the costs and benefits of IPRs, particularly at different stages of development. It seems clear, however, that IPRs do not automatically lead to learning and innovation, and may even jeopardize them. This is confirmed by the case study of the textiles and garments, agro-processing and pharmaceutical sectors in Bangladesh (Gehl Sampath, 2007a; subsection D.3). As argued by most experts, in the area of IPRs "one size does not fit all", and this implies that in the design and implementation of IPR policies it is necessary to consider the impact of varying levels of development and countries' initial conditions (CIPR, 2002; UNCTAD and ICTSD, 2005; Correa, 2000; UNIDO, 2006; UNCTAD, 2006a, 2006b and 2006c; World Bank, 2001). IPR protection has historically followed rather than anticipated economic and technological development.

Any process of technological upgrading is inconceivable without the strengthening of entrepreneurial capacity, but this cannot be achieved via technology policies alone.

Developing countries were subject under the TRIPS Agreement to the same standards of protection as those applicable to developed countries, subject only to transitional periods that have already expired. The same treatment was accorded to the LDCs; only longer transitional periods, renewable upon request, were permitted. As a result, LDCs are obliged to apply the same "minimum" IP standards as soon as the transitional periods expire or upon graduation. In many cases, TRIPS-plus regulations impose on LDCs even higher standards and obligations than on other WTO members.

However, TRIPS Article 66.1 recognizes that LDCs need a more flexible approach to IPRs, including the total lack of protection, in order to develop "a sound and viable technological base". LDCs still have the opportunity — until 2013 (and until 2016, in the case of pharmaceuticals) — to undertake an imitative path of technological development, as developed countries did in the past. However, that window of opportunity may close in a period shorter than

that enjoyed by the majority of developed countries, and although LDCs may have the freedom to imitate, foreign markets will be closed to their products, as higher standards of IP protection have almost become universalized. Since interactive learning is a time-consuming, cumulative process involving many agents, our recommendation is as follows:

- It is recommended that the transitional period for LDCs should not be subject to an arbitrarily predetermined deadline, but become enforceable only once those countries have reached, "a sound and viable technological base" (as stated in the TRIPS preamble).

It is recommended that the transitional period for the LDCs should not be subject to an arbitrarily predetermined deadline, but become enforceable only once those countries have reached, "a sound and viable technological base" .

Moreover, TRIPS Article 66.2 requires the granting of incentives to promote transfer of technology to the LDCs. The Decision of 19 February 2003 and the Doha Declaration are steps forward in the implementation of that provision, but concrete measures to facilitate access to technologies by LDCs are either non-existent or insufficient. It remains unclear which measures that could effectively contribute to mobilizing technology transfer by developed countries' enterprises to LDCs need to be adopted by developed countries. As required by Article 66.2, incentives should be given directly to enterprises and institutions, in developed countries, since that is where most of the technologies are located. That obligation cannot be met merely through cooperation provided by public agencies.

- It is recommended that the concept of "transfer of technology", for the purposes of compliance with Article 66.2, be elucidated by the WTO, so as to make it clear that developed countries' Governments should provide firm-based incentives for the transfer of IPR and non-IPR-protected technology, and that "technology" should be understood as manufacturing methods, formulae, designs, and basic and detailed engineering — that is, knowledge that may be effectively applied to upgrade the technological capacity of LDCs' recipients, as opposed to a simple transfer of general training and technical assistance or scientific cooperation. ·

Furthermore,

- It is recommended that developed countries effectively implement their obligations under Article 66.2 of the TRIPS Agreement by adopting special incentives, specifically aimed at facilitating the transfer of technology to LDC enterprises (such as tax breaks and subsidies), including machinery and equipment. With a view to avoiding any inconsistencies with other WTO rules and reducing uncertainty for prospective technology suppliers, the wording specifically allowing such incentives may be incorporated into the GATT Agreement on Subsidies and Countervailing Measures.·

It is recommended that the concept of "transfer of technology" , for the purposes of compliance with Article 66.2, be elucidated by the WTO and that "technology" should be understood as manufacturing methods, formulae, designs, and basic and detailed engineering.

An approach consistent with the concept underlying Article 66.2 should not be limited to the granting of incentives whose impact with regard to securing successful outcomes is doubtful. Although LDCs can delay the granting of patents in all areas, this only permits LDC firms to exploit inventions patented abroad in their own markets. This exemption is likely to have only a limited impact in terms of setting up competitive production facilities in LDCs (in which internal economies of scale are not likely to be achieved). Despite the fact that IPRs are "private rights", WTO member countries have no limitation on adopting, in the context of the WTO's special and differential treatment, measures exempting exports originating from LDCs from patent infringement actions in their jurisdictions.[39] In practice, such exemptions may benefit only a narrow range of products manufactured in LDCs, but may provide a strong incentive for investment and technological learning in particular areas with spillover effects in other sectors of LDCs' economies.

IPR-related technical assistance to LDCs should be premised on the understanding that the introduction of IPRs may entail significant costs with little, if any, benefits to LDCs.

It is recommended that developed countries effectively implement their obligations under Article 66.2 of the TRIPS Agreement by adopting special incentives, specifically aimed at facilitating the transfer of technology to LDC enterprises.

- It is recommended that the technical assistance provided by WIPO and other organizations be unbiased and, development-focused, and inform LDCs about all the flexibilities allowed by the TRIPS Agreement. The content and forms of delivery of IPRs-related technical assistance should be defined by the recipient Government, in accordance with its own priorities and development objectives and in full consultation with other stakeholders, including public-interest-oriented NGOs.
- It is recommended that studies assessing the economic impact of IPR regimes on the development of productive capacities in LDCs be carried out, with the assistance and cooperation of all relevant partners, inter alia those from the wider international community, including UNCTAD and civil society.

Moreover, certain LDCs acceding to the WTO have been required to forgo the transitional periods enjoyed by the original LDC members and to provide TRIPS-plus protection in several areas. There is no legal or economic justification for such requirements. This burden should not be imposed on new WTO members, in view of the recognition — in Article 66.1 of the TRIPS Agreement — that IPRs may constrain rather than accelerate the development of a viable technological base.

It is recommended that the LDCs currently in the process of accession to the WTO not be required to provide accelerated and TRIPS-plus protection.

- It is recommended that the LDCs currently in the process of accession to the WTO not be required to provide accelerated and TRIPS-plus protection, and be granted the same transitional periods as those granted to other LDC members.
- It is recommended that LDCs use to the fullest extent possible the flexibilities allowed by the TRIPS Agreement (parallel imports, compulsory licences, permissible exceptions to exclusive rights, fair use, etc.) and seek to avoid the erosion of such flexibilities through FTAs, BITs or trade agreements, or in the context of accession to the WTO.
- It is recommended that the inclusion of IPRs as "covered investments" be reviewed in any further bilateral or regional agreement.

1. Recommendations as per TRIPS flexibilities

It is recommended that LDCs use to the fullest extent possible the flexibilities allowed by the TRIPS Agreement (parallel imports, compulsory licences, permissible exceptions to exclusive rights, fair use, etc.) and seek to avoid the erosion of such flexibilities through FTAs, BITs or trade agreements.

- It is recommended that the international community reconsider the development dimension of the TRIPS Agreement, with a view to meeting the need for a balanced approach and pro-development IPR regime, especially with regard to LDCs.
- It is recommended that greater flexibility be built into the current patent system, with a view to obtaining more and longer special and differential treatment for LDCs.
- With a view to accommodating technological and knowledge asymmetries between economies, it is recommended that LDCs be granted LDC-specific IP standards with regard to novelty, nature of inventions, terms of protection and calibrated disclosure.
- It is recommended that with respect to TRIPS-plus provisions on patents, the scope of limitations and exceptions be increased in order to allow greater flexibility for IPR users. The full use of exceptions and limitations should be granted to LDCs, especially with regard to research and fair use.

- It is recommended that there be more flexibility in determining the terms of protection and the conditions for issue of compulsory licenses.

It is recommended that the international community reconsider the development dimension of the TRIPS Agreement, with a view to meeting the need for a balanced approach and pro-development IPR regime, especially with regard to LDCs.

2. Recommendations aimed at improving learning capacities

The LDCs should consider the following measures aimed at improving their learning capacities:

- LDCs should be afforded special arrangements to provide them with access to information and knowledge in the public domain, which is increasingly being eroded owing to the widespread application of stringent IPRs.
- It is recommended that IPR provisions be excluded in FTAs with LDCs.
- It is recommended that as regards the terms of licensing, licensing conditions be reviewed with a view to accommodating LDC-specific market conditions, including factor prices.
- It is recommended that the current TRIPS-plus policy regime trends (through FTAs and BITs) be reversed.
- It is recommended that LDC-based resources and knowledge be pooled in the search for economies of scale and collective efficiency solutions in all IPR-related institutional arrangements, including in multilateral forums.
- It is recommended that guidelines be developed in Patent Offices with respect to patentability criteria — that is, to examine applications carefully rather than simply copy international standards (in drafting national legislation).
- It is recommended that national legislation be drafted with a view to providing clear criteria definitions in line with countries' own conditions and needs, without discrimination aimed at preventing the "ever greening" of patents phenomenon (i.e. extension of patents that do not add value).
- It is recommended that third parties be introduced to challenge the granting of patents (as done, for example, in Israel, Pakistan India and Viet Nam).

It is recommended that IPR provisions be excluded in FTAs with LDCs.

All of the above should be reviewed with a view to making the IP system a positive force rather than a barrier to development.

As regards alternative non-proprietary mechanisms for knowledge governance, the LDCs, in collaboration with the international community, should explore a panoply of existing mechanisms, which are being successfully used in many other countries, in order to stimulate learning and knowledge governance — patent buy-outs, price discrimination mechanisms, public–private partnerships, subsidizing research (directly and indirectly) via grants, tax credits, fiscal measures to support R&D and other types of innovative activities, developing prizes, government-based advance market commitments, open source collective mechanisms, information and knowledge commons, compensatory liability regime ("use and pay system"), joint research initiatives of various kinds, local as well as regional technology-sharing consortia, joint research ventures and licensing agreements with technology transfer clauses. Moreover, improving linkages between S&T institutions and the enterprise sector is highly recommended.

It is recommended that LDC-based resources and knowledge be pooled in the search for economies of scale and collective efficiency solutions in all IPR-related institutional arrangements, including in multilateral forums.

- It is recommended that in order to encourage institutional diversity for enhanced knowledge ecology, a plurality of options be explored with a view to accelerating technological learning and innovation.

The underlying assumption of this Report is that the main challenge which policymakers in LDCs need to address is how to improve the knowledge ecology,

devise supportive policy frameworks and consider the plurality of options available with a view to better managing and benefiting from their own as well as already available knowledge resources. Establishing proprietary IP systems and creating property rights are but one response, among a number of responses, to a more generic and fundamental problem, which is how to create and improve their knowledge ecology. That challenge goes beyond fine-tuning the existing IPR regime.

Notes

1 This rapprochement has been intensifying since the introduction of software patents in the United States (an area subject to copyright in the TRIPS Agreement). Not all WTO Members have followed the United States approach.
2 This trend is identified with the "copyright maximalist" agenda that is currently being seriously challenged (David, 2005; Macmillan, 2003, 2005; South Centre, 2002, 2007; Musungu, 2005; Smiers, 2005; CIPR, 2002; Kozul-Wright and Jenner, 2007 forthcoming; Maskus and Reichman, 2005).
3 With respect to patent applications, data are available for only 17 LDCs; for varying years between 1999 and 2004.
4 See World Bank, World Development Indicators online.
5 Article 66.1 provides as follows: "In view of the special needs and requirements of least-developed country Members, their economic, financial and administrative constraints, and their need for flexibility to create a viable technological base, such Members shall not be required to apply the provisions of this Agreement, other than Articles 3, 4 and 5, for a period of 10 years from the date of application as defined under paragraph 1 of Article 65."
6 Compulsory licensing occurs when a Government allows someone else to produce the patented product or process without the consent of the patent owner. WTO rules on compulsory licences are outlined in Article 31 of the TRIPS Agreement and were reaffirmed in the Doha Declaration, adopted in 2001 (http://www.wto.org).
7 Parallel importation refers to "the importation of a good or service as to which exhaustion of an IPR has occurred abroad" (Resource Book on TRIPS and Development, UNCTAD and ICTSD, 2005: 93).
8 "Fair dealing" refers to the right granted by copyright laws to reproduce limited portions of copyrighted works without infringing the legitimate interest of the authors or copyright owners. This right exists in the United Kingdom and other regions whose copyright ordinances are derived from the United Kingdom, such as Australia, Canada, New Zealand and Hong Kong (China). In the United States, the term "fair use" is adopted.
9 See the WTO General Council Decision of 30 August 2003 for a system to address this issue.
10 Apart from a provision that exceptions should not unreasonably conflict with normal exploitation by the patent, taking into account the legitimate interests of third parties, Article 30 of the TRIPS Agreement does not define the scope or nature of permissible exceptions.
11 The issue of TRIPS-plus standards has been a sensitive one during stalled United States–Southern African Customs Union (SACU) free trade agreement negotiations with Lesotho being included.
12 Either the UPOV 1978 or the UPOV 1991 Convention.
13 See Article 46 (5) of the Agreement.
14 Some FTAs also restrict the use of test data for off-patent products.
15 "The extent to which the country provides protection of intellectual property rights consistent with or greater than the protection afforded under the Agreement on Trade-Related Aspects of Intellectual Property Rights described in section 101(d)(15) of the Uruguay Round Agreements Act".
16 AGOA has been in force between the United States and 48 sub-Saharan African countries since 2000, including 26 LDCs (source: http://www.agoa.gov/eligibility/country_eligibility.html).
17 This restriction does not apply to LDC members of ARIPO, which have more flexibility to mould their own patent legislation and practice.
18 See WIPO (2007b), Correa (2007), UNCTAD and ICTSD (2005) and UNIDO (2006).
19 Only 7 per cent of firms in LDCs engage in licensing (UNCTAD, 2006b).
20 See, for example, Maskus (2005: paragraphs 41–74).
21 In Brazil, for example, only one out of 176 "transfer of technology" contracts in the pharmaceutical sector registered with the National Institute of Intellectual Property included the exploitation of a patent. In 138 cases the use of trademarks was licensed (Elias, 2004).
22 The exception to this pattern occurs when there is a credible threat of compulsory licence or government use in accordance with Article 31 of the TRIPS Agreement. One example is the case brought before the South African Competition Commission by COSATU and others against GlaxoSmithKline, South Africa (Pty) Ltd and Boehringer Ingelheim, which eventually led to the negotiation of voluntary licences.
23 See the extensive literature, e.g., David and Foray (2003); Foray (2000, 2007); Von Hippel (2005); Jaffe and Lerner (2004); Suthersanen, Dutfield and Chow (2007); Nelson (2004).

24 For an exhaustive study of theory and evidence about the role of IPRs in technology transfer, see UNIDO (2006).
25 In contrast to patent protection, the protection under trade secrets has no acquisition costs, while competitors' cost and time involved in overcoming the secrecy barrier by legitimate reverse engineering may in some cases be substantial.
26 This is equally valid for SMEs in developed economies.
27 See Von Hippel (1981); Levin, et al. (1987); Cohen, Nelson and Walsh (2000); Scherer (2005); Arundel (2001).
28 See the empirical study by Levin, et al. (1987), which found that firms in 130 lines of business reported that patents were the least important means of securing competitive advantage for new products. See study by Cohen, Nelson and Walsh (2000), which concluded that in many different industries, being first to manufacture a product far outweighs the benefits of monopoly rents associated with patents.
29 Its results are corroborated by another broader study on the pharmaceutical sector in Bangladesh, which looks at all other components in the domestic knowledge system (such as universities, public research institutes, hospitals and clinics), in addition to the firms (Gehl Sampath, 2007b).
30 The main technology source variables were included when estimating the model for agro-processing only and pharmaceutical biotechnology only. None of them is significant, and they are jointly insignificant in each sector.
31 UNCTAD (2006c); CIPR (2002); Foray (2000, 2004); Correa (2000); Sampat (2003); Maskus and Reichman (2005).
32 There is strong evidence, for instance, suggesting that patents do not encourage R&D in pharmaceuticals for diseases prevalent in developing countries, as large pharmaceutical companies concentrate on projects leading to profitable drugs and tend to ignore those for which the effective demand is low (CIPR, 2002) .
33 For an analysis of patenting strategies, see Granstrand (1999) and OECD (2005).
34 According to the New York Times, TRIPS has become a mechanism for transferring rents from the South to the North. According to World Bank figures, the net obligation resulting from TRIPS amounts to more than $40 billion annually, which developing countries owe to American and European corporations (*New York Times*, 17 April 2007).
35 The Decision of the TRIPS Council of November 2005 also stipulates that in order to help LDCs draw up the information to be presented, and "with a view to making technical assistance and capacity building as effective and operational as possible, the WTO shall seek to enhance its cooperation with WIPO and with other relevant international organizations". The WTO has set up a working group on trade and transfer of technology to address this issue.
36 For a more extensive discussion of these mechanisms, see Foray (2007).
37 Utility patents are used in many countries, including Argentina, Armenia, Austria, Belarus, Belgium, Brazil, Bulgaria, China, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Ethiopia, Finland, France, Georgia, Germany, Greece, Guatemala, Hungary, Ireland, Italy, Japan, Kazakhstan, Kenya, Kyrgyzstan, Malaysia, Mexico, Netherlands, members of the African Organization of Intellectual Property, members of the Andean Community, Philippines, Poland, Portugal, Republic of Korea, Moldova, Russian Federation, Slovakia, Spain, Tajikistan, Trinidad and Tobago, Turkey, Ukraine, Uruguay and Uzbekistan.
38 As amply demonstrated in the literature on the economics of innovation, and contrary to Arrow's concept of a passive, automatic and costless process, the adoption of technologies requires deliberate efforts and investment (Radosevic, 1999).
39 The details of such an exemption should be carefully worked out in order to avoid fraud in its implementation as well as legal challenges based on eventual limitations imposed on the exercise of pre-existing rights.

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