

## 5 Technology Transfer

*One assumption of the TRIPS Agreement is that the "protection and enforcement of intellectual property rights" would contribute "to the transfer and dissemination of technology" (see box 2.3, above). Moreover, the Agreement stipulates that developed countries shall provide incentives to their enterprises and institutions for the purpose of promoting and encouraging technology transfer to least developed countries. It is also argued that stronger IPRs would be an inducement to foreign direct investment (FDI) - one of the channels for transfer of technology. It is therefore relevant to consider how these issues relate to each other, particularly in the context of a developing country.*

### Developing countries: net importers of technology

Given that most developing countries are net importers of new technologies and products, a critical source of technical change is incoming technology transfer. Technology transfer is a complex process, involving the shift of codified knowledge, know-how and management techniques.

It is fair to say that stronger IPRs reduce the scope for informal technology transfer via imitation, which was an important form of learning and technical change in such economies as Japan and the Republic of Korea (not to mention the United States). TRIPS has narrowed the options in this regard and raised the costs of imitation. At the same time, stronger patents, trademarks and trade secrets should reduce the costs of achieving formal technology transfer and expand such flows. However, evidence on this is not conclusive.

Formal private-sector technology transfer "is a commercial operation that takes place through firm-to-firm arrangements and involves flows of knowledge, be they embodied in goods (as in the sale of machinery and equipment) or in the form of ideas, technical information and skills (through licensing, franchising or distribution agreements) and

movement of experts and skilled labour.<sup>1</sup> Technology transfer can take place at arm's length, as in the case of the export of capital equipment or of licensing agreements between unaffiliated firms, or it can be internalised through the transfer of new production techniques within a transnational corporation, between affiliate firms".<sup>2</sup> Informal technology transfers can also take place on a large scale, and in those countries at the early stages of industrialization these may be far greater in number than formal transfers. Informal transfers can take place through printed information (such as sales catalogues, blueprints and technical specifications); observations made during visits to foreign plants; return of native, foreign-trained professionals; and the presence of foreign engineers.<sup>3</sup> By definition, informal transfers are not based on any monetary transaction or legal agreement. If IPRs exist to create markets for knowledge, such transfers presumably do not depend at all on the existence of IP protection. The remainder of this chapter deals with formal transfers.

There are several formalized means of transferring technologies, which include FDI, joint ventures, wholly owned subsidiaries, licensing, technical-

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service arrangements, joint R&D arrangements, training, information exchanges, sales contracts and management contracts.<sup>4</sup> Of these, FDI in some form

or another is the main channel for technology transfer flows.<sup>5</sup>

## IPRs and technology transfer

The relationship between levels of IPR protection and the volume and direction of inward technology flows is highly complex, and is likely to involve many factors whose relative importance will vary widely from one country to another. Theoretically, it seems logical to assume that IPR availability would be a prerequisite for the international transfer of new technologies, *at least those that can be easily copied*. One would expect companies to be reluctant to lose control over technologies, which may have cost them millions of dollars to develop, to countries where domestic firms could adopt the technologies and produce goods that would compete with those of the technology owners.<sup>6</sup> Accordingly, the only way that companies would feel encouraged to transfer proprietary technologies is where IPR protection is strong enough for them to charge licence fees high enough to reflect the costs of innovation, or alternatively by means of FDI or joint ventures where they maintain more control over those technologies.<sup>7</sup> According to Maskus,<sup>8</sup> in countries with strong IPR protection and enforcement, transnational corporations (TNCs) are likely to favour technology licensing agreements and joint ventures. In countries with weak IPRs, FDI would be the favoured business strategy in overseas markets.<sup>9</sup> Lall expresses the view that in the longer term, countries seeking to attract high-tech production systems should strengthen their IPR regimes with a view to inducing TNCs to deepen their investments into more advanced technologies.<sup>10</sup>

However, a great deal of formal international “technology transfer” takes place not between, but *within*, companies. Given that these companies continue to control access to the technologies, it seems reasonable to question whether such transactions are genuine technology transfers of the kind that would result in widespread adoption in developing countries. A counter-argument can be made that the *overall* effect of IPRs will inhibit technology transfers.

The views of the critics who argue that IPRs inhibit

technology transfer and reinforce North-South inequalities can be summarized as follows. As an intervention in the free market, patents restrict the number of people who could otherwise freely make, use, sell or import the protected products and processes. This enables owners to maintain high prices, avoiding a situation where the price of their products or processes is driven down towards the marginal cost of reproduction. Foreign patent owners can use their legal rights either to block access to their technologies or to charge licence fees that are too high for domestic firms. If so, one might argue that the best ways for developing-country governments to help domestic firms and public institutions to acquire technologies might be to weaken patent rights, such as by allowing compulsory licensing on licensee-friendly terms. According to Reichman and Hasenzahl “about one hundred countries recognised some form of non-voluntary licensing in their patent laws by the early 1990s.”<sup>11</sup>

This may not be the case, though, since reading a patent specification is unlikely to be sufficient to gain access to a technology. There are three reasons for this. First, patents do not necessarily disclose the invention to the extent that a person skilled in the art could manufacture it. Undisclosed tacit knowledge is often essential for reproducing an invention. Also, “in the public domain” is not synonymous with “freely available”. According to Stuart Macdonald of Sheffield University, “Legal fiction maintains that all the information needed to re-create the invention is contained in the patent specification. The fact is that the specification is forced to refer again and again to other information, information that is in the public domain, which means that it is available somewhere but must be acquired from these sources before the information in the specification can be used. Much of this information will be tacit and uncodified information [i.e. know-how].” Moreover, “the information contained in patent specifications is available only to those who consult them directly, or who pay others more adept at arcane classifica-

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tions and the language of lawyers to do so."<sup>12</sup> <sup>13</sup> Second, the possibility to take commercial advantage of information disclosed in expired patents may be precluded by multiple overlapping IPR portfolios. For example, companies sometimes apply for further

patents or use trademarks or copyright protection as a means of extending the life of a monopoly beyond the expiry date of the original patent. Third, many developing countries lack the institutional capacity to adopt and adapt new technologies.

*Patent ownership is heavily skewed in favour of the North*

## Who owns patents?

As for the geography of patent ownership, this is heavily skewed in favour of the North. Patent Cooperation Treaty statistics for 1998 and 2000 show that despite increased developing country membership in recent years, the vast majority of PCT applications continue to be filed by companies based in North America, Western Europe or Japan (table 5.1). Since such companies are the main users of the patent system, in the short term at least, they will be the major beneficiaries of new patent laws in developing countries. And, given the economic power of these

companies, it may be more difficult than ever for developing countries to negotiate favourable terms for technology. Drahos suggests a worst-case scenario: "If it turns out that the global market in scientific and technological information becomes concentrated in terms of the ownership of that information, it might also be true that the developmental paths of individual states become more and more dependent upon the permission of those intellectual property owners who together own most of the important scientific and technological knowledge."<sup>14</sup>

## Empirical evidence

What is the empirical evidence concerning the links between stronger IPRs, investment flows, R&D and technology transfers? The data produced so far are hardly conclusive, and suggest that FDI decisions may depend on a host of factors including the general investment climate. A study by Maskus<sup>15</sup> claimed some evidence of a positive correlation, while conceding that IPRs are one of several factors that may facilitate technology transfers, and also that strengthening IPRs will involve unavoidable costs<sup>16</sup> as well as benefits for developing countries.<sup>17</sup> A World Bank study was even more cautious and recommended further research before firm conclusions could be drawn.<sup>18</sup> Evidence from Turkey<sup>19</sup> found that the banning of pharmaceutical patents appeared to have no significant effects on levels of FDI, technology transfers or domestic innovation. Similarly, a study on Brazil, taking the manufacturing industry as a whole, found no evidence that FDI levels were greatly affected by patent protection.<sup>20</sup> On the other hand, Mansfield's well-known study (1994),<sup>21</sup> based on interviews with intellectual property executives of United States corporations in several industrial sectors, indicated that a large

proportion of respondents from the chemical and pharmaceutical industries said their FDI decisions *were* affected by the levels of IPR protection available.

Research by Kim for the UNCTAD-ICTSD Project on the experience of the Republic of Korea suggests that "strong IPR protection will hinder rather than facilitate technology transfer and indigenous learning activities in the early stage of industrialisation when learning takes place through reverse engineering and duplicative imitation of mature foreign products." He also concludes that "only after countries have accumulated sufficient indigenous capabilities with extensive science and technology infrastructure to undertake creative imitation in the later stage that IPR protection becomes an important element in technology transfer and industrial activities."<sup>22</sup>

Similarly, Kumar found that in the East Asian economies he studied (i.e. Japan, the Republic of Korea and Taiwan Province of China), a combination of relatively weak IPR protection and the availability of second-tier IPRs, such as utility models and design

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patents, encouraged technological learning. (See additional discussion in chapter 3, above). The second-tier systems encouraged minor adaptations and inventions by local firms. Later on, the IPR systems became stronger partly because local technological capacity was sufficiently advanced to generate a significant amount of innovation, and also as a result of international pressure. India's experience is somewhat similar, except that no

second-tier protection was provided. This did not hurt the chemical or pharmaceutical industries, but may have hindered the development of innovative engineering industries.<sup>23</sup>

In short, much uncertainty remains as to the effects of IPRs on technology transfers to developing countries. But there is empirical evidence to suggest that their effects depend on the level of development of

*Table 5.1: Geographical origin of patent applications filed under the Patent Cooperation Treaty, 1998 and 2000*

Region	Country of origin	No. of patents filed, 1998	No. of Patents filed, 2000	% of total 1998	% of total 2000
North America	USA	28,356	38,171	42.3	42.0
	Canada	1,315	1,600	2.0	1.8
<i>Total North America</i>		<i>29,671</i>	<i>39,771</i>	<i>44.3</i>	<i>43.8</i>
Western Europe/EU	Germany	9,112	12,039	13.6	13.2
	United Kingdom	4,383	5,538	6.5	6.1
	France	3,322	3,601	5.0	4.0
	Sweden	2,554	3,071	3.8	3.4
	Netherlands	2,065	2,587	3.1	2.8
	Switzerland	1,293	1,701	1.9	1.9
	Finland	1,092	1,437	1.6	1.6
	Italy	925	1,354	1.4	1.5
	Denmark	624	789	0.9	0.9
	Austria	421	476	0.6	0.5
	Norway	394	470	0.6	0.5
Others	1,101	1,463	1.6	1.6	
<i>Total Western Europe/EU</i>		<i>27,286</i>	<i>34,526</i>	<i>40.7</i>	<i>38.0</i>
East Asia and China	Japan	6,098	9,402	9.1	10.3
	Rep. of Korea	485	1,514	0.7	1.7
	China	322	579	0.5	0.6
<i>Total East Asia &amp; China</i>		<i>6,905</i>	<i>11,495</i>	<i>10.3</i>	<i>12.6</i>
Eastern Europe	Russian Federation	429	590	0.6	0.7
	Others	402	627	0.6	0.7
<i>Total Eastern Europe</i>		<i>831</i>	<i>1,217</i>	<i>1.2</i>	<i>1.3</i>
Australasia	Australia	1,048	1,627	1.6	1.8
	New Zealand	178	264	0.3	0.3
<i>Total Australasia</i>		<i>1,226</i>	<i>1,891</i>	<i>1.9</i>	<i>2.1</i>
<i>Total Middle East</i>		<i>707</i>	<i>925</i>	<i>1.1</i>	<i>1.0</i>
<i>Total Rest of Asia</i>		<i>146</i>	<i>473</i>	<i>0.2</i>	<i>0.5</i>
<i>Total Latin America/Caribbean</i>		<i>209</i>	<i>252</i>	<i>0.3</i>	<i>0.3</i>
<i>Total Africa</i>		<i>26</i>	<i>398</i>	<i>&lt;0.1</i>	<i>0.4</i>
<i>Total applications</i>		<i>67,007</i>	<i>90,948</i>	<i>100.0</i>	<i>100.0</i>

a country, the specific technological fields involved, and the behaviour and absorptive capacity of individual firms.<sup>24</sup> Accordingly, stronger IPR regimes are likely to benefit some countries, harm others and make no difference in yet others. But bearing in mind the highly concentrated market structures of some industries, the bargaining power of all developing countries and their companies in those industries is likely to be weak, and getting weaker still, especially the smaller countries that are unlikely to be an important market for the technology-owning firms. But the situation is not entirely bleak; there is some evidence from Africa to suggest a certain willingness of TNCs to share technologies on concessional terms.<sup>25</sup> However, often this is only as long as domestic companies do not produce competing products for sale in that market or abroad.

Simply strengthening and enforcing IPRs will not be sufficient to induce much more innovation and technology transfer. Experience from other countries suggests that a number of other factors are at least as important in establishing and benefiting from these processes. After all, innovation requires investment, suggesting that economies need to

provide an environment in which long-term investments and risk-taking can thrive.

In summary, one can say empirically, that intellectual property protection is one of many factors influencing firms' decisions to transfer technology to, or to invest in, a particular country. Therefore, it becomes evident that the effects of strengthened IP protection are often dependent on its interrelationship with the effects of other factors, such as the size of the domestic market, the structure of factor supply, productive infrastructure and the degree of stability of the macroeconomic environment. It is also worth noting that the theory and evidence available to date are based on the existence of different levels of IPRs in various countries. The question remains as to how the effective reconciliation of varying national IPR systems to the new, higher standards will affect the relative positions of countries in their IPR rankings and how this change will influence the global distribution of FDI flows. It is fair to expect that the other determinants of FDI and licensing will assume added importance.<sup>26</sup>

## CHAPTER 5: END NOTES

- <sup>1</sup> Governments are also involved in technology transfer. Informal and free-of-charge technology transfers are also possible.
- <sup>2</sup> Roffe, P, "Transfer of technology and competition policy in the context of a possible multilateral investment agreement", in Picciotto, S and Mayne R (eds), *Regulating International Business: Beyond Liberalization*, Basingstoke: Macmillan Press 1999:151.
- <sup>3</sup> Kim, L. 2002, op cit.
- <sup>4</sup> Mugabe, J and Clark, N, "Technology transfer and the Biodiversity Convention: issues of conservation and sustainable use", *Science, Technology and Development* 14 (3), 1996: 1-31.
- <sup>5</sup> See UNCTAD, "World Investment Report 2001", chapter 4 [hereinafter WIR]; and UNCTAD, *WIR 1999*, chapter VII. See also Radosevic, S, "International Technology Transfer and Catch-up in Economic Development", Cheltenham: Edward Elgar, 1999: 28.
- <sup>6</sup> Technologies cannot necessarily be easily be copied. Moreover, with technologies that can be copied, not all developing countries have the capacity to do so or make use of them. India and Brazil are much better placed than, say, a least developed country to copy advanced foreign technologies.
- <sup>7</sup> But having made this point, licensing agreements can also be quite restrictive with respect to the licensees' freedom to use and profit from the technologies.
- <sup>8</sup> Maskus, K, "Intellectual Property Rights in the Global Economy", Washington DC: Institute for International Economics, 2000: 123.
- <sup>9</sup> Similarly, Vishwarao suggests the possibility that gains for developing countries from lack of IPR protection would be "offset by strategic behavior by Northern firms who opt for technology transfer via subsidiary or monopoly production" (Vishwarao, S, "Intellectual property rights and the mode of technology transfer", *Journal of Development Economics* 44, 1994: 381-402).
- <sup>10</sup> See Lall and Albaladejo, op. cit: 15.
- <sup>11</sup> Reichman J and Hasenzahl C, "Non-voluntary Licensing of Patented Inventions: Historical Perspective, Legal Framework under TRIPS, and an Overview of the Practice in Canada and the United States of America". Study undertaken within the framework of the UNCTAD-ICTSD Capacity-Building Project on IPRs and Sustainable Development, Geneva, UNCTAD-ICTSD, 2002. Available at [http://www.ictsd.org/iprsonline/unctadictsd/docs/reichman\\_hasenzahl.pdf](http://www.ictsd.org/iprsonline/unctadictsd/docs/reichman_hasenzahl.pdf)
- <sup>12</sup> The relevance of tacit knowledge goes further than merely casting doubt on the notion of patents as a reward for disclosing an invention. Even without patents, companies may enjoy a powerful position, since those wishing to acquire tacit knowledge may have no alternative but to license it from holding firms. See Macdonald, S, "Exploring the hidden costs of patents", *QUINO Occasional Paper* No. 4, Geneva: Quaker United Nations Office, 2001.
- <sup>13</sup> This situation may be changing somewhat with patent databases being placed on the Internet.
- <sup>14</sup> Drahos, P, "States and intellectual property: the past, the present and the future", in Saunders, D and Sherman, B (eds), *From Berne to Geneva: Recent Developments in Copyright and Neighbouring Rights*, Brisbane: Australian Key Centre for Cultural and Media Policy and Impart Corporation, 1997.
- <sup>15</sup> Maskus, 1998, op cit
- <sup>16</sup> In terms of legislation, administration and enforcement. See discussions in chapter 2 above.
- <sup>17</sup> See also United Nations Conference on Trade and Development, *The TRIPS Agreement and Developing Countries*, 1996, op. cit.; Finger, JM and Schuler, P, "Implementation of Uruguay Round commitments: the development challenge". Presented at the WTO/World Bank Conference on Developing Countries in a Millennium Round, WTO Secretariat, Geneva, 20-21 Sept. 1999.

- <sup>18</sup> Primo Braga, CA and Fink, C, "International transactions in intellectual property and developing countries". Mimeo. Washington, DC: World Bank 1999.
- <sup>19</sup> Kirim, AS, "Reconsidering patents and economic development: a case study of the Turkish pharmaceutical industry", *World Development* 13 (2), 1985: 219-236.
- <sup>20</sup> Kondo, EK, "The effect of patent protection on foreign direct investment", *Journal of World Trade* 29(6), 1995: 97-122.
- <sup>21</sup> Mansfield, E, "Intellectual property protection, foreign direct investment and technology transfer", Washington, DC, International Finance Corporation, Discussion Paper No. 19, 1994.
- <sup>22</sup> Kim, L, 2002, op. cit.
- <sup>23</sup> Kumar, N, "Technology and Economic Development: Experiences of Asian Countries", London: Commission on Intellectual Property Rights Intellectual Property Rights, 2002.
- <sup>24</sup> Kim L, 2002, op cit.
- <sup>25</sup> See Stokes, K, "Intellectual property rights and the transfer of biotechnology to Zimbabwe", *Biopolicy International* No. 20, Nairobi: ACTS Press, 1998.
- <sup>26</sup> See UNCTAD, 1996, op.cit.: 18.

