Technology Transfer and Intellectual Property Rights: The Korean Experience

By Linsu Kim

The protection of intellectual property rights (IPRs) has become an increasingly important issue in multilateral trade negotiations. The current debate is polarised, pitting advocates for strong IPR protection – who argue that it is an effective instrument for facilitating technology transfer to developing countries – against those taking the opposite view.

Recent studies, including one commissioned by UNCTAD and ICTSD[1], have found that the effects of IPRs on technology transfer to – and local innovation in – developing countries will vary according to the country's level of economic development and to the technological nature of its economic activities, and that countries can reap long-term benefits from strong IPRs only after they reach a certain threshold level in their industrialisation. Indeed, strong IPRs would thwart developing countries from attempting industrialisation at the very early stage. And under such an IPR environment, few are likely to emerge as newly industrialising economies.

This position is confirmed by the experience of South Korea. This article summarises a case study conducted by the author based on a long period of research on the behaviour of firms in technology transfer and local capacity-building in that country.

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Technological Development of Newly Industrialising Economies

During the early stage of industrialisation, developing countries acquire mature foreign technologies from industrially advanced countries. Lacking local capability to establish production operations, local entrepreneurs develop production processes through the acquisition of 'packaged' foreign technology, which includes assembly processes, product specifications, production know-how, technical personnel and components and parts. Production at this stage is merely an assembly operation of foreign inputs to produce fairly standard, undifferentiated products.

Once the acquisition task is accomplished, production and product design technologies are quickly diffused within the country. Increasing competition from new entrants spurs indigenous technical efforts in the assimilation of foreign technologies to produce slightly differentiated products. The relatively successful assimilation of imported technology and increased emphasis upon export promotion, together with the enhanced capability of local scientific and engineering personnel, lead to the gradual improvement of mature technology. Technological emphasis during this stage is duplicative imitation, producing knockoffs and clones.

In the face of rising wages and increasing competition from the second tier newly-industrialising economies (NIEs) like Thailand and Malaysia, firms in the first tier NIEs such as Korea and Taiwan, which have successfully acquired, assimilated and sometimes improved mature foreign technologies, aim to repeat the same process with higher-level knowledge in the intermediate technology stage. Technological emphasis at this stage is creative imitation, generating facsimile products but with new performance features. It involves not only such activities as technology transfer and benchmarking but also notable learning through substantial investment in research and development (R&D). Many industries in Taiwan and Korea have arrived at this stage.

If successful, some of these industries may eventually accumulate sufficient indigenous technological capabilities to generate emerging technologies and challenge firms in advanced countries. Innovation is the watchword in these industries. When a substantial number of industries reach this stage, the country may be considered to be a member of the advanced countries.

This oversimplified model provides a fairly accurate explanation of the evolutionary process that took place in the first tier NIEs in East Asia. In the 1960s and 1970s when the local technological base was very primitive, Korea and Taiwan first acquired and assimilated mature technologies to undertake duplicative imitation of existing foreign products with their skilled but cheap labour force. Consequently, the accumulation of technological capability through learning-by-doing, together with the quality upgrading of the educational system, enabled these countries to undertake creative imitation in the face of rising labour costs and increasing competition from the second tier NIEs.

Many East Asian economies such as Thailand, Malaysia, Indonesia, Vietnam and the Philippines are at the mature technology stage, undertaking duplicative imitation of existing foreign products with cheap labour forces. In contrast, other countries such as coastal China and some of the East European economies may not evolve in the same way, as they had a longer history of technological accumulation before they opened their economies. Some of the sectors in these economies may have enough capability to enter the intermediate technology stage at the outset. If they evolve from the mature technology stage, the speed of evolution to the intermediate technology stage should be relatively fast.

The Korean Experience

Korean firms entered the mature technology stage in the 1960s and 1970s by acquiring, assimilating, and improving generally available mature foreign technology through various mechanisms based on duplicative imitation. As the industrialisation process unfolded and Korean firms mastered manufacturing competencies in the duplicative imitation of standardised, low-cost products, they needed to upgrade their indigenous capabilities and manufacture more value-added products in the face of increasing local wages and emerging competitive threats in the labour-intensive production from the second-tier developing countries. This forced Korean firms in the 1980s to shift their emphasis from strategies focusing on labour-intensive mature technologies to those focusing on relatively more knowledge-intensive intermediate technologies across all the sectors.

To tackle challenging new technological tasks, which were beyond their existing capabilities, Korean firms across industrial sectors largely focused their technological efforts on three major areas:

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foreign technology transfer through formal mechanisms, the recruitment of high calibre human resources from abroad, and local R&D efforts. In addition, the government invested heavily in upgrading university research and diversifying its research institutions.

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 are readily available in various forms. Even if such technology was patented, foreign patent holders were lenient in controlling such duplicative imitation, as it was no longer useful in sustaining their international competitiveness.

Technologies at the intermediate stage were a lot more complex and difficult to acquire and adopt. Foreign patent holders were much more determined to control imitation by developing countries, because such technologies continued to play a pivotal role in expanding their international business activities and sustaining their competitiveness. Thus, Korean firms had increasingly to resort to formal technology transfer such as foreign direct investment (FDI) and foreign licensing (FL). This is evident from statistics. FDI increased from US$218 million in 1967-1971 to US$1.76 billion in 1982-1986, while royalties associated with FL increased from US$16.3 million to US$1.18 billion during the same period. Capital goods imports also increased drastically from US$2.5 billion to US$50.9 billion during the same period.

Developing countries should work to change the trend towards standardised and all-encompassing IPR systems.

In parallel with enhanced efforts in acquiring knowledge-intensive technologies through formal mechanisms and the mobility of high calibre human resources, Korean firms intensified their own R&D activities to strengthen their bargaining power in technology transfer, expedite learning from acquired technology, and to mitigate foreign technological dependency. R&D investment has seen a quantum jump in the past three decades from US$28.6 million in 1971 to US$ 4.7 billion by 1990, and to US$ 12.2 billion by 2000. The Korean economy recorded one of the world's fastest growth rates, yet R&D expenditure rose faster still. As a percentage of GDP, R&D increased from 0.32 percent to 2.68 during the same period, surpassing that of many West European countries.

Consequently, there has been significant structural change in R&D investment. The government played a major role in R&D activities in the early years, when the private sector faltered in R&D despite the government's encouragement. More recently, domestic firms have assumed a much larger role in the country's R&D efforts in response partly to increasing international competition and partly to a supportive policy environment. While the private sector accounted for only 2 percent of the nation's total R&D expenditure in 1963, this had risen to over 80 percent by 1994. This is one of the highest among both advanced economies and NIEs.

The R&D growth rate is the highest in the world. The average annual growth rate in R&D expenditure per gross domestic product (GDP) in 1981-1991 was 24.2 percent compared to 22.3 percent in Singapore, 15.8 percent in Taiwan, 11.4 percent in Spain, and 7.4 percent in Japan. The average annual growth rate of business R&D per GDP is also the world's highest at 31.6 percent, compared to 23.8 percent in Singapore, 16.5 percent in Taiwan, 14.0 percent in Spain, and 8.8 percent in Japan. Private sector R&D is conducted almost entirely by domestic firms. As of 2000, only 39 multinational corporations – or 1.4 percent of the total number of MNCs manufacturing in Korea – have established R&D centres in the country, accounting for less than one percent of the total number of corporate R&D centres in Korea. Most of these R&D centres are small and involved largely in adapting products to local market needs. This is a common practice of MNCs operating in developing countries.

In addition to intensified in-house R&D, Korean firms began globalising their R&D activities. LG Electronics, for instance, has developed a network of R&D laboratories in various developed countries. These outposts monitor technological change at the frontier, seek opportunities to develop strategic alliances with local firms, and develop state-of-the-art products.

The government invested heavily in expanding and deepening university research in the intermediate technology stage. The Korean government and the POSCO steel corporation founded three new research-oriented universities specialising in science and technology. The government also enacted the Basic Research Promotion Law in 1989, targeting universities to upgrade their research capabilities. As a result, university research has expanded substantially. The Korean government also increased the number of government research institutions (GRIs) from just one to over twenty, and these began to play an important role in strengthening the bargaining power of local enterprises in acquiring increasingly sophisticated foreign technologies. For instance, when Corning Glass refused to transfer optical fibre production technology to Korea in 1977, two large local copper cable producers entered a joint R&D project with a GRI. The locally-developed optical cable was tested successfully on a 35-km route in 1983. Although this effort eventually ground to a halt due mainly to slow progress in R&D, it nonetheless helped local firms gain bargaining power in acquiring foreign technology on favourable terms.

Thus, Korea has rapidly evolved from the mature technology stage, undertaking duplicative imitation through reverse engineering, to the intermediate technology stage, undertaking creative imitation through formal technology transfer, the recruitment of higher calibre scientists and engineers, and intensified local R&D activities. In this intermediate technology stage, IPRs became important even for local firms. This is evident in patent statistics. Patent activity in Korea has increased significantly in the last two decades compared to the first two, increasing a mere 48 percent in the first 14 years (1965-1978), but almost tripling in the next 11 years (1979-1989), and almost tripling again in the next four years (1989-1993). Furthermore, the share of Koreans in local patent registration also increased from 11.4 percent in 1980 to 69.2 percent by 1999. Korean firms also became active in registering foreign patents. For instance, Korea jumped from 35th in terms of the number of patents in the US in 1969, to 11th with 538 patents in 1992, representing an average annual growth rate of 43.32 percent. By 1999, Korea had jumped to 6th position with 3,679. Samsung Electronics was ranked 4th with 1,545 US patents, only after IBM, NEC and Cannon, indicating Korea's seriousness in securing patent rights at home and abroad.

Over the decades, a significant number of local firms have managed to grow dynamically from primitive small firms to large modern ones. This is particularly the case for most large local pharmaceutical and cosmetic firms and some paper and chemical firms, which imitatively developed their own primitive production processes to become large innovative firms over decades.

For instance, leading local pharmaceutical firms first started as importer/dealers of packaged finished drugs and later entered the

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The Baia Mare accident produced widespread trans-boundary contamination and sparked public outrage in Europe, setting the stage for discussions on how to elaborate standards on cyanide management and emergency response. To address these concerns, in May 2000 the United Nations Environment Program (UNEP) and the International Council on Metals and the Environment (ICME) took the lead and chose the members of a Steering Committee for the elaboration of the Code. The Committee consisted of participants mainly from the mining industry, and only some from government, academia, NGOs, labour and financial institutions. For the couple civil society organisations that engaged in the discussions, however, it was soon clear that industry had hijacked the process. The Cyanide Code has been criticised since as greenwash, 'giving the appearance that the regulatory inadequacies have been addressed, without actually requiring the changes necessary to protect communities and the environment.'

The Cyanide Code is not intended to derogate from laws and regulations, but to complement them. Also, compliance is entirely voluntary and does not create enforceable rights or obligations. To administer the Code, a non-profit corporation controlled by the gold mining industry was established: the International Cyanide Management Institute. Gold companies that become signatories to the Code are not required to have all of their operations certified, only those that they have specifically requested. In turn, cyanide suppliers and transporters can become Code supporters and may conduct audits, but cannot become signatories.

Some see the Cyanide Code as greenwash that requires no actual changes to protect either communities or the environment.

The Code is comprised of principles that broadly state voluntary commitments, and standards of practice for the management of cyanide. Independent third-party audits, including site inspections and review of records, will verify every three years whether operations meet the standards of practice and will certify compliance if warranted. Only a summary of the audit report will be made available to the public on the Code's website. Operations that are only in partial compliance will be conditionally certified, subject to the successful implementation of an action plan to be posted on the Code's website. The Institute will develop a procedure for the resolution of disputes regarding auditor credentials or otherwise arising from the certification scheme.

Conclusion

Many questions remain open in the mining certification debate, such as who would set the standards and in what process; how standards would incorporate public participation and access to information; what monitoring and oversight roles for communities; who would verify compliance; what kind of markets could provide a preference for certified products, facilities or companies; and the role of financiers and insurers in a certification scheme. More generally, certification schemes raise issues regarding market access, eco-labelling and the applicable terms of the WTO's TBT Agreement. What is clear is that mining certification is being discussed in a variety of fora. Industry retains a clear interest in distinguishing leaders from laggards, and certification is viewed as a tool for accomplishing this. In contrast, communities are wary of a tool that may serve to green-wash unfulfilled promises by an industry with a meager record of compliance and respect for human and environmental rights.

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drug manufacturing business by packaging imported bulk drugs. Then, they gradually extended into more intricate operations, first by formulating imported raw materials and later, through backward integration, by producing the chemical components. Through this process, they grew in size and in technological capabilities. As a result, local firms accounted for almost 90 percent of the domestic drug market in Korea as compared to 22 percent in Brazil, 47 percent in Argentina, and 30 percent in India in the early 1980s.

During this period, Korea honoured only process patents but not product patents in the chemical, cosmetics, and pharmaceutical industries, opening an avenue for local producers to work around patented processes to produce relatively well known chemical and pharmaceutical products. Were it not for such lax IPRs, it would have been impossible for the local pharmaceutical firms to have achieved so much. Some of them have now advanced technologically to a level where they can undertake serious R&D activities and discover new drug compounds.

Some Lessons

The study offers four important lessons. First, 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. Second, 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. This suggests that Japan, Korea and Taiwan could not have achieved their current levels of technological sophistication if strong IPR regimes had been forced on them during the early stage of their industrialisation. The same applies to the United States and Western Europe during their industrial revolutions. This article explains how these conclusions were reached.

Third, if adequate protection and enforcement of IPRs is genuinely intended to enhance development, policy makers should seriously consider differentiation in terms of the level of economic development and industrial sectors. Otherwise, the 'one size fits all' approach is a recipe for disaster for developing countries, particularly for the least-developed ones. Fourth, developing countries should work together to change current trends towards a standardised all-encompassing multilateral IPR system. They should strive to make IPR policies more favourable to them in the short term. But they should also strengthen their own absorptive capacity for a long-term solution that would enable them to identify relevant technology available elsewhere, strengthen their bargaining power in its transfer to them in more favourable terms, assimilate it quickly once transferred, produce creatively imitative new products around IPRs, and generate their own IPRs.

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ENDNOTE

[1] Sanjaya Lall and Manuel Albaladejo. 2001. *Indicators of the Relative Importance of IPRS in Developing Countries*. ICTSD/UNCTAD; http://www.ictsd.org/unctad-ictsd/docs/Lall2001.pdf. For a summary, see Bridges Year 6, No.3, page 13.