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ABSTRACT

This paper argues that three major issues need to be addressed when examining the effects of the WTO's TRIPs agreement on capability building in developing economies. First, the agreement looks at seven instruments, which have both common as well as differing implications for capability building in developing economies. Second, four major theoretical arguments address the agreement, i.e. market-oriented, regulation, path-dependent knowledge dynamics and network synergies, and public and basic good characteristics of certain IPRs. Third, the capacity of economies to participate actively in the agreement depends on basic and high tech capabilities. The LIDEs have neither the basic infrastructure to ensure compliance nor the high tech infrastructure to support innovative activities. The Asian NIEs – especially the Republic of Korea - enjoy strong high tech and innovative capabilities. The second-tier NIEs and Latin American NIEs are generally endowed with strong basic infrastructure to strengthen compliance, but lack the high tech infrastructure to support innovative activities. Indeed, The LIDEs on average show higher levels of high tech infrastructure and resident patents than the second-tier NIEs. However, Indonesia and Philippines face serious shortcomings even in basic infrastructure.

Keywords: World Trade Organisation, Trade Related aspects of Intellectual Property Rights; Capability Building; Innovation; Developing Economies

1 INTRODUCTION

Global governance involving intellectual property rights (IPRs) has increasingly gained momentum following the introduction of the Trade Related aspects of Intellectual Property Rights (TRIPS) agreement under the World Trade Organisation formed in 1995. Unlike the old debate where the focus has largely been confined to patents, the TRIPs agreement has brought together seven critical instruments where the consequences can be considerably different.

Four major theoretical arguments can be linked to the TRIPs agreement. The first and second extend the contestation between the free marketeers and the interventionists. The third argument views knowledge as having cumulative and path-dependent as well as synergy dynamics that when driven across society will raise the productive capabilities of all agents – exponentially expanding systems efficiency. The fourth argues that public and basic needs goods command different demand and supply characteristics so that their effective allocation would require special governance procedures.

While the factors that influence capability building are far too complex to draw predictable effects from the TRIPs agreement, the prevailing capability dynamics of developing economies to a large extent enables inferences on its potential ramifications. Hence, any effort to examine the potential implications of the TRIPs agreement will have to address the state of technological capabilities and institutional support facilities in the individual economies. However, the narrow definition of innovative activities used in this section – caused by data constraints - remains a limitation of the paper.

This paper attempts to examine the important issues involving the enforcement of the TRIPs agreement for technological capability building in developing economies. It is organised as follows. The first discusses the specificity and diversity that characterises the agreement. The second looks at the major theoretical arguments that relate to the TRIPs agreement. The third analyses the capability dynamics of developing economies. Three categories of developing economies are distinguished in the paper. The first category refers to the NIEs where the high tech infrastructure is fairly developed for firms to participate in the TRIPs agreement (Republic of Korea, Hong Kong, Singapore, Chile, Mexico, Turkey, Israel and Brazil).[2] The second category refers to second-tier NIEs that show relatively high growth rates but lack the high tech infrastructure to engage actively in the TRIPs agreement (Argentina, Indonesia, China,

[2] Data for Taiwan was not available.

Malaysia, Philippines, Thailand and Venezuela). The third category refers to LIDEs.[3] This group includes the non-European transitional and communist economies and other poor developing economies (e.g. Burundi, Cambodia, Rwanda, Uzbekistan, India, Pakistan, Peru and Burkina Faso).

[3] This categorisation was preferred to the least developed economies as when technological capability is added to standards of living these economies share many things in common.

2 DIVERSITY OF INSTRUMENTS UNDER THE TRIPS AGREEMENT

In principle, the TRIPs agreement refers to the application of property rights to the creators and owners of intellectual property. The common IPR instruments include patents, copyrights, trademarks and trade secrets. Patents are governed by procedures and processes used to derive the product or service. The TRIPs agreement is arguably and most comprehensive of global IPR management regimes to have emerged. Governed under the WTO that was formed in 1995, the TRIPs agreement brings together all the different IPR management under one umbrella – but with coordination from the other related organisations (e.g. WIPO).

Trademarks are registered when individual firms - driven strongly by high entry barriers caused by marketing costs - seek to protect their products and services that are strongly tied to brand identification. Where patents are neither desirable nor difficult to protect (e.g. drinks and tires), firms typically use trade secrets and confine regulation to trademarks. For example Coca Cola, MacDonald and Pirelli use trade secrets and trademarks to protect their products. It is difficult for those copying the formula used to produce either products to be successfully prosecuted easily as the processes used to make these products are difficult to verify. Hence, companies producing such products typically do not seek patents as the procedures will disclose to the public the processes used to make these products. Instead, these firms keep the technology as a trade secret and build its reputation and product identification with trademarks. Trademarks and patents are also held simultaneously by some companies– e.g. Mercedes, Sony and Intel. Creators of literary works, art and computer programmes qualify for protection under copyrights. Other IPR instruments include identification of products by geographical location, industrial designs,

The early formal institutions for the protection of intellectual property evolved in Europe several centuries ago. However, the modern application of IPRs can be traced to Europe and the United States from the 19th century. Subsequent efforts to enforce the recognition of IPRs – through trade and other means - increased in the last two decades of the 20th century. The World Intellectual Property Organisation (WIPO) became a major forum for coordinating and administering intellectual property matters. Intellectual property governance reached its furthest penetration internationally with the Trade Related Intellectual Property Rights (TRIPs) agreement under the World Trade Organisation. This section discusses the institutional evolution of international governance and the state of IPR institutions in Asian economies.

Seven critical instruments constitute the TRIPs agreement, which integrated the key tenets of prevailing IPRs in 1995. The TRIPs agreement integrated a number of international IPR conventions, including the Paris Convention,[4] Berne Convention[5] and the Washington Treaty[6] of 1989. The purported aim of TRIPs was to avert trade tensions by introducing more order and predictability in the system and to settle disputes more smoothly. It covers seven areas of IPRs (see Appendix 1),[7] *viz.*

- Copyrights and related rights[8]
- Trademarks (product and service)
- Geographical indication
- Industrial designs[9]
- Patents[10]
- Layout-designs of integrated circuits
- Undisclosed information (including trade secrets)

On paper, the TRIPs agreement aims to streamline the governance of IPRs more systematically and with consensus. Each of the IPR instruments generates different effects.

Copyrights

Copyrights historically dealt with the protection of literary and work of art for a period of 50 years. Bootlegging and live performances were added later and these things carry similar features with works of art. Given its output from individual talents, irrelevance to basic needs or public goods, and its lack of limiting properties to prevent path dependent technical change, this instrument is often supported as a means of protecting small artisan producers typical of small

[4] The Paris Convention addressed the protection of industrial property.

[5] The Berne Convention dealt with the protection of literary and work of art.

[6] The Washington Treaty included layout designs of integrated circuits.

[7] The agreement dealt with issues: 1.application of the agreement, 2.protection of IPRs, 3.enforcement of IPRs domestically, 4.settling of IPR disputes involving WTO members and 5.establishment of transitional arrangements during the evolution of the new system (WTO, 2001: 2).

[8] The TRIPs agreement added computer programmes and live performances (bootlegging) to literary and works of art under copyrights, which offers protection for not less than 50 years.

[9] Industrial designs enjoy protection for at least 10 years (WTO, 2001: 4).

[10] Patents are protected for at least 20 years (WTO, 2001: 4-5). However, patent holders must supply the products to the market to avoid revocation.

batch pre-capitalist production forms. However, the inclusion of computer programme have somewhat diluted this instrument. While individual software programme writers enjoy some characteristics with the traditional definition of small producers having no control over markets, the main programmes marketed have general uses that is critical for societal efficiency. Examples include the microsoft package.[11] Poor consumers will find it very difficult to purchase such packages. Hence, it could be argued that the spirit of the Berne convention is not captured when computer programmes are added to copyrights. Besides, given the typically short product cycles involving computer programmes, the enforcement of copyrights is likely to slowdown product launches in the field.

Copyrights – if administered fairly - may actually assist developing economies to protect a whole range of literary and works of art, music, movies and other related products. In fact, this is one way of balancing the flow of revenue as the developed economies have established prices on almost any resource originating from there. In the absence of effective copyright governance it can be argued that the bigger firms from developed economies are likely to dominate its extraction and hence the appropriation of much of the value added associated with it.[12] Given the advantages, it is important that developing economies build their IPR infrastructure to protect their literary and works of art and other cultural and biological specimens.[13]

On the one hand, it can be seen as a useful mechanism as it 'replaces' the unilateral application of IPR conditions in trade by the United States against its trade partners. The developing economies have particularly faced serious pressure from the United States in the past. On the other hand, the unequal capacities and representation of WTO members is likely to manifest into a highly concentrated institution so that the interests of especially the developing economies will not be effectively protected. In fact, some feel that the United States will use the WTO to pursue formally its interests. Hence, it is extremely important for continuous negotiations for consensus building if the WTO is to shed its image as a rich man's club.[14]

The developed economies were required to comply with the TRIPs agreement within one year of the formation of the WTO. The NIEs had to conform with the agreement by 1996. The Least Developed Countries were required to meet the TRIPs obligations by 2006. The remaining

[11] An unpirated copy of the programme cost US$400 in Kuala Lumpur on 31 October 2001 (interviews by author).

[12] As argued earlier, the inclusion of computer programmes within copyrights seems misplaced.

[13] There are already numerous complaints over the piracy of bio-resources of developing economies (see BBC Monitoring, 1999).

[14] Unscrupulous regulations that are achieved through consensus building using horse-trading methods will do little to convince the developing economies about the role of WTO.

economies that were classified as developing were required to meet the TRIPs obligations by 2000. The second-tier NIEs came under that category.

Trademarks and Geographical indication

Given that trademarks can apply to any product and carry no intrinsic properties, efforts to protect it should not raise efficiency alarms. The only problem with its enforcement is the costs very poor developing economies will have to bear to install the security mechanisms necessary to prevent violations. Bangladesh, Mali, Mauritania, India and Myanmar do not have the financial resources to offer sufficient basic needs goods for a huge portion of their populations. Also, building brand names often entail enormous investments that drive up retail prices and unnecessarily raise entry barriers for nascent firms – particularly those located in developing economies. Hence, the typical industrial organisation argument states that extensive product differentiation often adds costs that – while raising rents and shields for the big firms – can be wasteful for society. Hence, while it is not necessary to contest access to IPR instruments that protect name by trademarks (e.g. Coca Cola, Mercedes, Intel, Toyota), it may not be desirable economically and might be too expensive for poor economies to ensure compliance beyond outlawing such activities. Firms from LIDEs – as is the case with the disadvantaged in unregulated markets – lack the marketing and advertisement resources to build their trademarks. Besides, dominant foreign firms can easily purchase local brands to access domestic markets.

Geographical indication shares similar properties with trademarks, though a number of brands using this clause did not require extensive investment through advertisements – e.g. Bhasmati rice, Tequila and Havana cigars. There is also no need for licensing to ensure name protection. However, the rules on this is somewhat murky as an American firm has contested the right to use the hybrid brand name Jasmathi following its successful efforts to cross Bhasmati rice with Jasmin rice. [15] Nevertheless, such name identification is applied across the world and can also involve products from LIDEs. However, given the financial and legal resources required to contest violations, developing economies remain disadvantaged even with this instrument.

Patents

By far the most controversial TRIPs instrument is the patent. The patenting authority in individual countries issues a patent after declaring the applications over a specified period. The periodisation of patents in the past often depended on the weight attached to the effort by

[15] See Bello (1999).

individual governments, as sufficient to motivate innovators without discouraging entry by competitors and other innovators. Its administration has changed so much that the emphasis on patents has shifted from processes to products. Process manipulation can no longer be used as the basis for new patent application. Least developed economies that use process-based patent laws must now make their patents TRIPs-consistent by 2006. However, the patent carries considerably different properties and thus, its implications for microchips would differ from bio-organisms.

It may seem that a 20-year patent is just too long given the frequency of innovations. What constitutes a significantly different product may deny newcomers lacking the tacit knowledge as well as financial endowments to face overly high risk to develop new products. Especially when expenditures involving branding, scaling and other items are so high, producer markets are likely to become so concentrated that prices and access to essential products such as drugs might not reach the needy. While richer governments could subsidise these products, it will remain outside the reach of the poor developing economies.

The protection of bio-organisms from pillage by multinational corporations is critical to protect the natural origins of these items. LIDEs have been historically plundered off their bio-resources to serve dominant interests in the developed economies. A separate instrument is necessary to prevent the past practice of colonisers and dominant private interests siphoning off fauna and flora from LIDEs incapable of exploiting their resources. Current efforts under the TRIPs to support patenting by the first-movers should be re-examined as a consequence. The IPR instrument preferred should distinguish products and processes where commercial, aesthetic and public interests conflict.

Industrial and Layout designs of ICs

A ten-year protection period on industrial and IC layout designs is unlikely to generate the same impact as patents. Rival firms could redesign industrial products and IC layouts and hence should not face serious impediments in their efforts to access path-dependent knowledge to appropriate synergies from such shields. The Asian NIEs have successfully surmounted this problem and hold several such licenses of products whose designs were derived or improved from the original design holders.

Not only is the period shorter, the specific designs and layouts does not prevent rivals and newcomers from achieving the same or better results using different designs. It could be viewed as minimum shields that the original creators could associate their creation physically. Even here rivals have often designed their products to look almost similar to licensed design holders.

It is not uncommon to find Toyota or Hyundai cars resembling in design with Mercedes or BMW vehicles.

Undisclosed information

Contrary to the condition of disclosure, which is a key tenet of the licensing process, firms can withhold information involving some products because of its specific characteristics that make verification difficult. Most of these firms prefer to build a brand name, as a trademark, to identify the product. Apart from protection accorded to the trademark, violations related to such products involve the piracy of such secretly guarded knowledge – e.g. through the acquisition of key personnel in control of such knowledge. Examples of products where firms generally keep their technology as trade secrets include soft drinks, tyres and fast food.

These items neither impose restrictions on the growth of path-dependent knowledge nor impede access to essentials in the developing economies. Hence, its inclusion in the TRIPs agreement should not be viewed a threat to technological build up in developing economies. While it can be argued that especially the least developed economies do not have the legal and financial capacity to prevent the pillage of information, it offers disadvantaged nations an avenue to contest potentially damaging acquisition of tacit and confidential knowledge embodied in personnel by MNCs.

In addition, given that the defining characteristic of patents is its novelty, unpatented products created in LIDEs that eventually get patented by others can be contested through a court process.[16] However, efforts by developing economies to contest using the novelty argument would require enormous financial support and a professional legal team. Most LIDEs lack the resources and the awareness to pursue these issues in international fora. Their primary concern revolves around the provision of basic needs for the majority. Hence, there is clearly a need for LIDEs members to cooperate and share resources to protect their interests.

Unlike typical theoretical arguments, it can be seen that the seven TRIPs instruments differ considerably so that it is difficult to just capture their dynamics and relevance from any single school. This necessitates a review of prevailing arguments in the context of the different instruments, which is undertaken in the next section. While the current protection conditions accorded to patents and industrial designs under the TRIPs agreement is stifling for beginners and infants, its removal need not guarantee successful technology development. As the experience of England, Germany, United States, France, Japan and the Asian NIEs show,

[16] The Indian government successfully fought for the dismissal of patents issued to American firms on neem and tumeric powder on these grounds.

specific strategies grafted onto local structures were critical in facilitating technology absorption and domestic capability building.[17] Many LIDEs lack effective strategies to engender capacity building and industrial upgrading. Hence, domestic capability building efforts should be made a critical objective of LIDEs.

[17] See List (1885) on Germany, Gerschenkron (1962) on the United States and European economies, Freeman (1987) on Japan and Lall (1996) on the Asian NIEs.

3 DOMINANT DEBATES

The primary economic debate involving the TRIPs agreement is whether the world would be better off with technology related regulation. Supporters of market forces argue that there should not be any regulation so that the virtues of market-determined resource allocation can be harnessed. Market advocates abstract from the hypothetical perfect competition model. Since product and service differentiation is not possible and perfect information conditions ensure flow of technology to all firms, the IPR mechanism cannot exist in perfectly competitive markets. Societal utility functions are considered to equilibriate with supply conditions so that market clearing conditions (both product mix [including tastes] and prices) are achieved. However, most arguments assume partial equilibrium because of information imperfections and the problem of substitutability in real factor and product markets. Advocates of monopoly rents as a spur to stimulate innovation point to the risky and uncertain nature of investments directed to such activities (Schumpeter, 1934; 1943). Evolutionary economists working on technology argue that there are path-dependence and synergistic implications of knowledge creation and diffusion so that efforts to regulate could restrict the overall systemic synergies that could be appropriated – both static and in dynamic. Some economists argue that privately governed regulation of knowledge involving public and basic needs goods would reduce systemic efficiency levels and hence limit the spread of such goods to society. Such advocates call for public and communal mechanisms to govern the administration of such IPRs.

a. Market-oriented

As with other restrictions, advocates of market forces are opposed to the introduction of IPRs. The arguments are based on *a priori* assumptions that interventions will reduce overall global welfare. Working on the assumptions of the relative factor price theoretic, regulation is considered to distort resource allocation.

One of the most systematic attack on regulation – though, driven by hypothetical assumptions - comes from the advocates of perfect competition. Under perfectly competitive markets - where firms operate as price takers producing homogenous products or services for the final market using factor supplies that are also perfectly substitutable with no information imperfections – no

patents are possible.[18] Any discovery of a product or process technology achieved by one firm will quickly reach the rivals so that the abnormal profit earned in the short run will disappear in the long run as other firms access the new technology without additional costs. New firms will enter production to wipe out the additional profits if the new technology offers rents – so that in the long run all remaining firms just enjoy normal profits. High cost producers will leave if the new technology reduces the economically Pareto efficient number of firms. Because first mover advantages do not exist in perfectly competitive markets, firms operate primarily as followers without systematic efforts to develop technologies. Indeed, technology evolves slowly in such markets. Such markets are considered to generate Pareto efficient market equilibrium and better distribution in society. In fact, perfect market assumptions of perfect factor substitutability (between capital and labour) and disembodied technical progress formed the basis for Solow's (1956) computation of total factor productivity (TFP). Advocates of perfect competition recognise that it is not possible to achieve such markets in reality, but contend that its desirability should drive efforts to drag resource allocation along such principles. Even if not achievable – the exponents argue that the closer one gets there the better it will be for society (Hahn, 1984).

Unlike perfectly competitive markets, market-oriented economists work on real markets and examine imperfect markets but remain committed to confining allocation decisions to markets. Hence, free traders such as Bhagwati (2000)[19]call for the removal of IPRs, arguing that a free society will have its own mechanism of rewarding innovators making society relatively better off. Inherent imperfections – such as learning effects, scale and a lack of perfect information and factor substitutability – are considered less important than when external interventions are allowed. Without regulation, it is assumed that acquirers will have a free role to develop other products that require path-dependent access to knowledge from the unpatented products.

Three major criticisms exist against advocates of free trade. First, critics argue that under free market conditions– even if possible – technical change will evolve very slowly so that the long run welfare gains will be sub-optimal when compared to markets where innovation related rents are available. Especially when lumpy investments are involved – particularly in the period

[18] Perfectly competitive markets are characterised by assumptions of free entry and exit where thousands of firms produce homogenous products or services with perfect information access and perfect factor-substitution options.

[19] Bhagwati (1978) had worked extensively on the advantages of free trade, confining analysis to the static benefits of specialising to reap the benefits of scale. Bhagwati (2000) does recognise the need for wage increments, assisting the poor and the significance of new innovations – but believes that a free economy will handle that best.

between basic research breakthroughs and when commercially viable products hit markets – firms look for protection (Merges and Nelson, 1998). Second, private agents are unlikely to honour societal norms if the room exists to shirk or free ride, and to prevent disclosure in the absence of intervention. Hence, the distributive advantages of free trade cannot be realised. Third, critics argue that unregulated markets will inevitably become concentrated as dominant interest groups establish their economic power. Hymer (1972) offered arguably the most cogent argument on the development of multinational corporations – i.e. they evolve to benefit from oligopolistic control of markets.[20] Multinational corporations are likely to dominate in the absence of regulation.[21] Rising concentration through mergers and acquisitions have reduced the number of firms in automobiles, pharmaceuticals, and iron and steel industries (see UNCTAD, 1998). In other words, the self-regulating society that is so important to Bhagwati's equilibriating argument would be dominated by powerful interest groups so that resource allocation will embody less the interests of the majority.[22]

b. Innovation Rents

Supporters argue that IPRs act as 1.rents to offer incentive to stimulate initiative and 2.reward the original owners. The first point is a pure economic argument predicated on stimulating investment in risky innovative activities. The second argument is driven by proprietary rights considerations - that the owners should enjoy the right to reap economic benefits. The application of the first can generate different results independent of the second, as holders cannot necessarily raise rents above what is economically desirable for overall economic welfare. With the second point, owners can raise rents above what welfare maximising globally.

As for the first, it is often argued that several innovations require lumpy investments in R&D that can be extremely uncertain. Unless there are economic benefits at the end, firms are unlikely to invest so much in uncertain activities, which would slow down the innovation process. The additional risks associated with innovative activities are considered to deter investments unless rents exist to offset them. This is the Schumpeterian argument that innovators are likely to tread untested and uncertain paths to innovate when there is potentially

[20] This is also the new growth exposition (see Grossman and Helpman, 1991; Lucas, 1988; Romer, 1986). The original ideas can be traced to Young (1928), Kaldor (1957) Abromovitz (1956).

[21] Directly refuting Rugman's (1981) claim that multinational corporations exist to internalise transactions to overcome externally created distortions.

[22] This point was well articulated by Polanyi (1957) and Kornai (1962).

greater stream of returns to garner. Two major aspects of this argument can be examined. First, is the spur to discover or create new things. Second, is the scale of investment involved to develop products commercially viable from the discoveries. Strictly speaking, profit-oriented firms are unlikely to invest in risky innovation-related activities when returns are equal or are lower than the more secure rates of returns (e.g. bank rates etc). Since innovations – both path-breaking and major path-dependent - are necessary to stimulate new spurts of growth and further minor innovations, rents[23] are perceived as necessary to optimise long-run returns and welfare.[24] Indeed, Schumpeter (1934) ridiculed the followers while glorifying the innovators.[25] This argument forms the basis for the introduction of patents. However, despite calling for monopoly rents, Schumpeter did not advocate the closure of competition. In fact, competition is central to his argument, which he referred to act as "gales of creative destruction" to force firms to actively shape the technology frontier.

Supporters of patents under the TRIPs agreement also argue that it offers information disclosure for quicker and wider diffusion, and an orderly pursuit of development to prevent "over-fishing" (see Merges and Nelson , 1998). Public institutions and private universities have often used this argument to seek patents (particularly broad-based ones) to seek funding for basic research, which they then jointly develop with private firms to appropriate commercially viable products. Given that firms seldom participate in basic research, which is critical for generating especially path-breaking knowledge, this arrangement is often seen as useful.

A number of criticisms can be advanced against the regulationists. First, critics argue that incentives and other forms of regulation will raise entry barriers and restrict the competition necessary to drive innovations. It can be argued that a minimum of 20 years for patents could stifle new innovation. It is also often argued that regulation will add costs in a chain of business transactions that would restrict economic efficiency. Second, as Scherer (1984) contended, imitation lags often offer first movers natural advantages.[26] Third, studies show that scientists working on basic research hardly look to monetary rewards when seeking scientific breakthroughs. With the exception of pharmaceutical industries, the available evidence suggest

[23] These productive economic rents – which raise the equilibrium prices above current Marshallian market clearing rates - are considered to offer higher welfare in the long run.

[24] Perfectly competitive markets are also considered to impede innovations as little economic advantages await the successful bearers of uncertainty and risk.

[25] To Schumpeter (1934), innovators create new spurts of growth.

[26] This point can be disputed especially when the technological gap between innovators and followers is narrow. This is also often the case when involving product technologies facing increasingly shortening product cycles such integrated circuits.

that patents are not important motivators for firms to invest in R&D (see Scherer, 1959; Taylor and Silberston, 1973; Mansfield, 1986; Levin, Klevorick, Nelson and Winter, 1987; Arundel and Paal, 1995; Goto and Nagata, 1996).

Fourth, by erecting barriers, patents could actually restrict path-dependent and related innovations (see Scotchmer and Green, 1990; Merges and Nelson, 1990; Lerner, 1995; Green J. and Scotchmer, 1995). Patents on systemic technologies that demonstrate path-dependent connections – e.g. interface involving software technologies such as computer programme – will reduce societal synergies (see Samuelson, Davis, Kapor, Reichman, 1994). Fifth, there is no logical institution that is autonomous of binding interests to govern the allocation and coordination of rents so as not to escalate dissipation costs. Sixth, governments often lack the information and the cohesion to resolve market failure (see Aoki, Murdock and Okuno-Fujiwara, 1996). Seventh, the information disclosure argument has rarely been supported from empirical evidence. Commercialisation has not only increasingly driven R&D to targets determined by effective demand rather than needs, it has also raised concentration in markets of basic needs' products. General Electric and Westinghouse, AT&T, and Intel became virtual monopolies in the production of light bulbs, telephones and microprocessors respectively for decades as a consequence.

c. Path-dependence and Systemic Dynamics of Knowledge

Evolutionary economists make the point that innovations often occur from the cumulative accumulation of knowledge – i.e. there is path-dependence in the growth of stocks of knowledge that drives innovations (Rosenberg, 1982 Nelson and Winter, 1982; Freeman, 1986). Various stocks of past knowledge were never or only partly subsumed and priced under IPRs. OECD economies with strong IPR instruments themselves benefited extensively from free past knowledge generated from developing economies. Especially systemic technologies such as software programme and genes demonstrate considerable path-dependent characteristics (see Merges and Nelson, 1990). Historically, genes and medicines are just a few critical technologies that merchants appropriated cheaply or freely from the developing economies in the past. In fact, reverse engineering – which is expressly forbidden under the TRIPs agreement – formed a major channel for technology transfer from Europe to the United States,[27] England to Germany, and Germany to Switzerland in the 18^{th,} 19th and 20th centuries respectively. A whole range of

[27] Best (2001) discusses in detail how Springfields Armoury in the United States reverse engineered ammunition manufactured using French technology.

laws and enforcement efforts were taken without much success to protect individual self-interests by these economies.[28]

In addition, because firms rarely participate in blue-sky research – development of basic concepts and theory – the initial foundation for product or service development was seldom privately funded. Hence, the formulation of private IPRs are considered to unfairly misallocate costs since the basic knowledge involved is generally socially funded – indirectly drawn from a whole range of funds (e.g. taxes etc). The cumulative nature of the evolution of knowledge and improperly defined public good properties make IPRs an oppressive instrument by the owners against others seeking to use them.

The economic benefits of smoother and quicker information flows to all sections of society far outweighs the individual gains a few agents achieve from regulation (see World Bank, 1998). The free flow of knowledge will facilitate greater inter-firm differentiation and division of labour, continuous re-integration of production, which will help build network cohesion to expand new firm creation and speciation capabilities. At the level of the firm, continuous information flows will stimulate simultaneous industrial upgrading and innovations in firms.[29] Technological constraints in some firm will easily become market opportunities for other firms. At the level of the society, an integrated network of individuals, firms and institutions will help the generation and appropriation of systems synergies exponentially.[30] Especially when enabled with ICT – including the internet, then it helps improve access and expand the flow of new knowledge. Under such a framework a range of agents – individuals, firms and institutions - can access new information cheaply and quickly as transactions costs would fall. With a higher information pulse rate, network dynamics become stronger. Stronger, quicker and larger links facilitate greater networking and systemic synergies.

The current framework of IPRs is considered technically to restrict information flow across society. On the positive side is the claim that IPRs involve disclosures that help standardise and simplify the procedures involving innovations so that latecomers can easily access them with less costs. However, on the negative side is the criticism that IPRs themselves minimise disclosures and they act more to limit new information flows in the interest of owners. While it

[28] See Chang (2001) for a lucid historical account.

[29] Network cohesion will facilitate the achievement of Young's (1928) thesis on differentiation and division of labour, and Best (2001) incisive accounts of systems integration.

[30] See Rasiah (2001) for a brief account of the systems synergy possibilities achieved from integrated networks. See Best (2001) for the conceptual assessment of speciation capabilities.

can be argued that the lack of security measures prevent firms from effecting disclosures, critics argue that disclosure mechanisms themselves have been deliberately framed to restrict information flows. Given that it is critical to expand systems synergies and strengthen inter-firm and societal network cohesion, it will be important to formulate IPRs that enhance rather than limit information flows.

d. Public and Basic Needs Goods

Several product and service innovations involve knowledge that is public in character and has evolved out of public rather than private needs. In addition, basic research is generally funded by government or related institutions. Basic research generates considerable externalities where private firms cannot corner all the returns exclusively for themselves. Much of this knowledge remains tacit despite efforts to convert them to explicit knowledge. While a range of rules has been enacted to bind human capital in which much of tacit knowledge is embodied, no mechanism can completely plug knowledge leaks. In fact the inventors of new technology are seldom the ones to appropriate most of the returns triggered by it.

There is another argument that posits that scientific discovery historically has been driven more by curiosity and the desire to benefit society than by any other factors. Social needs rather than private profits have been argued to be a major driver of innovations. This point was echoed by 13 eminent scientists from the Royal Society of Britain in an open letter to the *Financial Times* in 2001.[31] Privately registered IPRs are considered to embody less societal need as their profit-seeking objective would drive them to engage scarce resources towards the wants of the rich. Under such circumstances, IPRs may be used to protect private rather than public interests. This brings to fore the classic conflict between those with the monetary means to demand and those without that to support their basic needs.

Basic needs' products have also come under the TRIPs agreement. A major conflicting but related debate involving pharmaceutical firms has emerged. While past studies show that patents have been important stimulants in stimulating R&D in pharmaceutical products, the evidence is also obvious that it has come at the expense of such exorbitant prices (see Merges and Nelson, 1998) that it will be beyond the reach of most disadvantaged people in the developing economies. MNCs from developed economies are debating over the production of generic AIDs drugs by cheap producers in the developing economies. TRIPs efforts to confine

[31] Indeed these scientists called for the removal of the trade related intellectual property rights agreement on the grounds that "scientific curiosity and concerns to help humankind" were the prime drivers of innovation.

exclusive rights to patent holders over a period of 20 years - could deny some of the absolute poor from keeping themselves alive.[32] This debate surely calls for a serious overhaul in the formulation and implementation of TRIPs agreement so that it would not prevent critical access to the disadvantaged.

Three pragmatic methods – all of which require government intervention and multilateral coordination – to resolve the problem of public and basic needs goods access to all require a differentiation of products. Monopoly pricing of basic needs' products in the past was avoided when governments intervened to:

- Subsidise prices of basic needs goods so that it reaches those who need them.[33]
- Include basic drugs for price control
- Strengthen anti-trust regulations to prevent concentrations of capital from defining market conduct.[34]

The WTO discourages the use of the first two practices. The proliferation of substantially cheaper generic drugs for critical illnesses such as aids – without which millions could die – against those patented is a case worth exploring.[35] The anthrax problem that threatened to explode into a serious crisis had already brought back this debate onto the boardroom. Generic drug makers – benefiting from national patent laws (e.g. India) that makes it legal for firms to produce drugs legally so long as the processes are different –offered a potentially cheaper and quicker solution to potential epidemics. Canada had actually overridden Bayer's patent on Cipro – an anti-biotic drug to treat for the anthrax virus - before reversing it later in 2001 (see Harmon and Pear, October 19, 2001).[36] It is extremely unconvincing to argue that a 20 year patent on drugs will be welfare enhancing in the long run.

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[32] The long patent tenure under TRIPS is among the most contentious and hotly disputed items of the WTO.

[33] This should be classified as non-actionable subsidy so long as these goods (including drugs) are not competing against other similar drugs.

[34] Anti-trust efforts to strengthen consumer rights and welfare has seen considerable development in the United States, though, its trend after Reagan has seen a reversal.

[35] The production of imitation aids drugs by India and the granting of licenses for the production of HIV drugs to South Africa and Thailand.

[36] The Canadian government had ordered a million tablets of the generic version from a Canadian company before the reversal of its stand. An Indian generic drug maker offered to supply the United States with 20 million tablets a month of anthrax antibiotic, offering a strong

Critics argue that when uninformed or self-interested governments intervened in markets the usual problems of government failure will arise. Even clean and efficient governments hardly have the information to identify the right issues and the methods for resolving them as knowledge evolves unevenly from all sections of imperfect societies.[37] Others claim that the incentive to invest resources in basic needs' products will fall if governments press for price caps and anti-trust regulations. This problem can be magnified in several LIDEs as underdeveloped and corrupt government machinery could divert resources away from the needy. However, some scientists prefer to pursue more pragmatic paths by calling governments of poor nations to improve their IPR mechanisms to protect their intellectual property – including genetically engineered foods.[38] A wide range of unprotected intellectual property – especially involving copyrights involving literary and works of art - has been siphoned off historically from the LIDEs to the developed economies.

The arguments for and against prevailing TRIPs instruments prove inconclusive. Both the market-oriented and the regulationists have their strengths and weaknesses. The dynamics becomes far more complex if it is recognised that knowledge also constitutes path-dependent and systemic, and spillover and basic goods properties – which often conflict with private property rights. The likely theoretical option to adopt should be one that integrates the strengths of all, though, it is extremely difficult to unbundle these features and integrate them as a policy instrument. The knowledge dynamics and public good argument adds further ammunition to differentiate and redefine IPRs so as to harness the externalities associated with network cohesion and knowledge flows appropriately, and ensure public and basic needs goods' access to all.

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case that drug patents should be reconsidered in medical emergencies (Reuter, October 17, 2001).

[37] See Aoki, Murdock and Okuno_Fujiwara (1996) for a discussion of their market enhancing view.

[38] The famous Indian Scientist, Swaminathan, takes this position (BBC Monitoring, 2000a)

4 INSTITUTIONAL SUPPORT AND INNOVATIVE CAPABILITIES

The TRIPs agreement will have a bearing on those technology channels where the seven instruments apply. Some channels – e.g. organisational and non-tangible processes – remain outside its governance. While the agreement is increasingly promoting the convergence of IPR coordination and implementation, weak institutional development in especially the LIDEs have continued to widen the gaps and asymmetries between them. The capacity to participate in the TRIPs agreement would obviously also depend on the level of technology development achieved by the individual economies – support infrastructure and participation in innovative activities. The lack of active participation – owing to both dominant roles by the developed economies as well as underdeveloped domestic infrastructure – threatens to aggravate technology development in developing economies. Indeed, Mytelka (2001) underscores this point as the most serious problem facing technological governance in the poor economies.[39] This section discusses the status of infrastructure – both basic and high tech – and innovative status of developing economies, using the basic infrastructure index (BII), high technology infrastructure index (HII) and the Residents patents index (RPI) (see Tables 1, 2 and 3 for proxies and formulas used to compute these indexes). Given the lack of internationally comparable information involving most IPR instruments, this section only deals with patents as a proxy of innovative status, which is the most contentious but documented instrument.

Basic Infrastructure

Basic infrastructure is an essential but not a sufficient condition for economies to achieve technological capabilities. The lower the BII of an economy – constituting of equally weighted proxies representing basic education (enrolment in primary schools), health (physicians per thousand people) and communications (main telephone lines per thousand people) – the lower its capacity to target resources for high tech development. In addition, economies with low BII also would lack the essential services necessary to support high tech activities.

Developing economies as a group, on average, show an underdeveloped basic infrastructure (see Figure 1). The BII figure for most of these economies was much smaller than that of the developed and European transitional economies. Within developing economies, the first-tier and second-tier NIEs enjoyed a far higher BII, but still fell short of levels achieved by the developed

[39] Also, unless the IPR institutions are developed, enforcement will always be difficult.

and European transitional economies. All the first-tier NIEs had BII figures exceeding the global mean (see Table 1). Although there are still weaknesses, the NIEs have strengthened significantly their basic infrastructure to comply with the TRIPs obligations.[40] Especially after 1985 – through pressure primarily from the United States, the Asian NIEs have strengthened their IPR instruments so that copyright infringements have fallen drastically. Their licensing fees have also risen through the additional IPR legal and infrastructure costs.[41]

The picture with the second-tier NIEs was mixed. Indonesia and Philippines had poor BII figures. The remaining second-tier NIEs reported in Table 1, i.e. Argentina, China and Malaysia, enjoyed BII figures exceeding the global mean. The second-tier NIEs of China, Malaysia, Venezuela and Thailand have increasingly strengthened their IPR infrastructure although they lack the capabilities to facilitate extensive technology development.

The BII figures for the LIDEs were extremely low compared to the global mean (see Figure 1). Especially Haiti, Malawi, Bangladesh, Mauritania, Mali, Lesotho, Niger, Rwanda, Togo, Djibouti, Equatorial Guinea and Yemen had extremely low levels of basic infrastructure (see Table 1). The state of basic infrastructure in these economies was so poor that they are unlikely to have the resources to target high tech infrastructure development. Efforts to enforce compliance of the TRIPs agreement will only sap their already stretched resources away from basic utilities. Many of these economies lack even the instruments to facilitate proper patenting domestically. Unless assistance arrives from the richer economies, it will be extremely difficult for these economies to enforce such hotly contested issues as the piracy of brand names.

[40] Even though violations still exist.

[41] Samsung's entry and early expansion into integrated circuits manufacturing occurred primarily from technology licenses from foreign companies (see Edquist and Jacobssen, 1986).

Figure 1: Basic Infrastructure Index, 1992-98

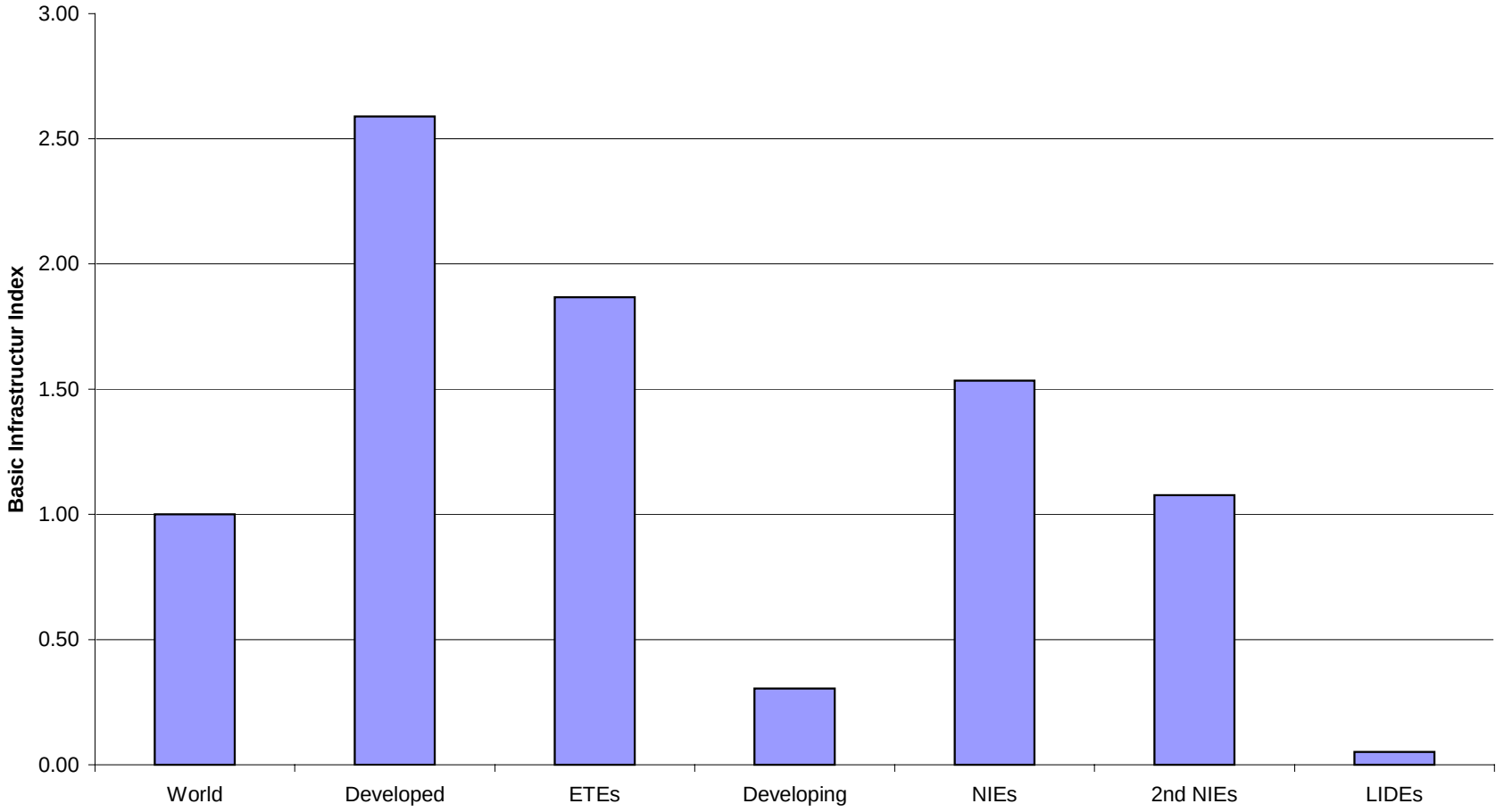


Table 1: Basic Infrastructure Index, 1992-98

Economy	BII	Economy	BII	Economy	BII
Albania	0.74	Guyana	0.61	Oman	0.86
Algeria	0.76	Haiti	0.15	Panama	1.35
Argentina	1.85	Honduras	0.64	Paraguay	0.69
Australia	2.44	Hong Kong	1.99	Peru	0.90
Austria	2.41	Hungary	2.29	Philippines	0.33
Bahamas	1.81	Iceland	2.79	Poland	1.72
Bangladesh	0.17	Indonesia	0.36	Portugal	2.47
Barbados	1.70	Iran	0.70	Romania	1.43
Belarus	2.12	Ireland	2.11	Russia	2.01
Belgium	2.69	Italy	3.07	Rwanda	0.09
Belize	0.99	Jamaica	1.03	Saudi Arabia	1.08
Bolivia	0.57	Japan	2.26	Senegal	0.20
Brazil	1.15	Korea, Rep.	1.76	Singapore	1.64
Bulgaria	2.29	Kuwait	1.45	Slovenia	2.05
Canada	2.46	Kyrgyz Rep.	1.40	South Africa	0.95
Chile	1.28	Latvia	2.06	Spain	2.75
China	1.08	Lebanon	1.45	Swaziland	0.29
Colombia	1.11	Lesotho	0.16	Sweden	2.95
Costa Rica	1.20	Libya	1.06	Switzerland	2.84
Cuba	1.27	Macedonia	1.75	Syria	1.02
Czech Rep.	2.13	Madagascar	0.18	Tanzania	0.09
Djibouti	0.21	Malawi	0.11	Togo	0.15
Ecuador	1.01	Malaysia	1.05	Trinidad and Tobago	1.17
El Salvador	0.80	Mali	0.07	Tunisia	0.82
Equatorial Guinea	0.27	Malta	2.45	Turkey	1.49
Estonia	2.18	Mauritania	0.13	United Arab Emirates	1.41
Finland	2.64	Mauritius	1.25	United Kingdom	2.17
France	2.71	Mexico	1.12	United States	2.67
Georgia	1.69	New Zealand	2.28	Uruguay	2.10
Germany	2.67	Nicaragua	0.59	Uzbekistan	1.33
Greece	2.79	Niger	0.05	West Bank & Gaza	1.51
Guatemala	0.73	Norway	2.74	Yemen, Rep.	0.18

Note: Basic Infrastructure Index (BII) calculated using the formula $[E_j(\Sigma E_i)^{-1}H_j(\Sigma H_i)^{-1}C_j(\Sigma C_i)^{-1}n^3]^{1/3}$ where the variables E, H and C refer to equally weighted country proxies of education (percentage enrolment in primary education), health (physicians per 1000 people) and communication (main telephone lines per 1000 people), the subscripts $_j$ and $_i$ refer to country j and i and n the number of countries used.

Source: Computed from World Bank Institute (2001) data.

High Tech Infrastructure

While basic infrastructure is essential, the incidence of economies generating innovations is higher when they also have the high technology support institutions. Although the HII is not exhaustive as several other proxies such as incentives for high technology activities and high tech equipment consumed in domestic demand were not included, it still offers a useful

indicator of the technological support distance of individual economies against the global mean. Economies with low HII figures are unlikely to attract significant levels of firms' participation in innovative activities.

Although the HII index for developing economies was much less than that for the developed and European transitional economies, the gap was not as sharp as that for basic infrastructure. This is attributed to a number of developing economies showing relatively high numbers of scientists and engineers and R&D investments in gross national investment respectively. Figure 2 reveals a few stark facts about the high technology institutional support capabilities of developing economies. First, the first-tier NIEs HII is almost close to that of the European transitional economies. Second, the second-tier NIEs show the lowest average HII among the groups of economies shown. In fact, the LIDEs show a higher HII than the second-tier NIEs, suggesting that the latter lacks the institutional support facilities to participate extensively in innovative activities.

Among the first-tier NIEs, the republic of Korea and Singapore had high HII figures of 2.14 and 1.39 respectively. However, the first-tier economies of Brazil, Chile, Mexico and Turkey had low HII figures of between 0.23 and 0.47. Even if Taiwan and Hong Kong are included, the Asian NIEs are likely to show a high HII figure. For example, in the period 1982-96, Taiwanese firms held 0.85 percent of the patents filed in the United States, ranking fifth overall (Albert, Yoshida and Opstal, 1998: Table 2). The same cannot be said of the Latin American first-tier NIEs.

The Southeast Asian second-tier NIEs of Malaysia, Philippines and Thailand showed very low HII figures of 0.10-0.16 (see Table 2). Among the second-tier NIEs, only Argentina and China showed appreciable HII figures of 0.43 and 0.47 respectively. This evidence adds to the growing arguments that the second-tier Southeast NIEs lack the institutions to support sustainable growth *a la* the Asian first-tier NIEs (see Rasiah, 1998). In fact, these economies were already slowing down before the financial crisis struck in 1997-98 (Rasiah, 2001a).

Some economies are so poorly endowed that they appear unlikely to support any significant participation in innovative activities. Senegal, Madagascar, Rwanda, Uganda, Ecuador, Buskina Faso and Bangladesh had HII figures of less than 0.10, which is extremely low. These economies face the dual problem of extremely poor basic and high tech infrastructures. For these economies not only will compliance be a serious issue, it is unlikely that these economies can afford the resources even to participate in the definition and future direction of the TRIPs agreement.

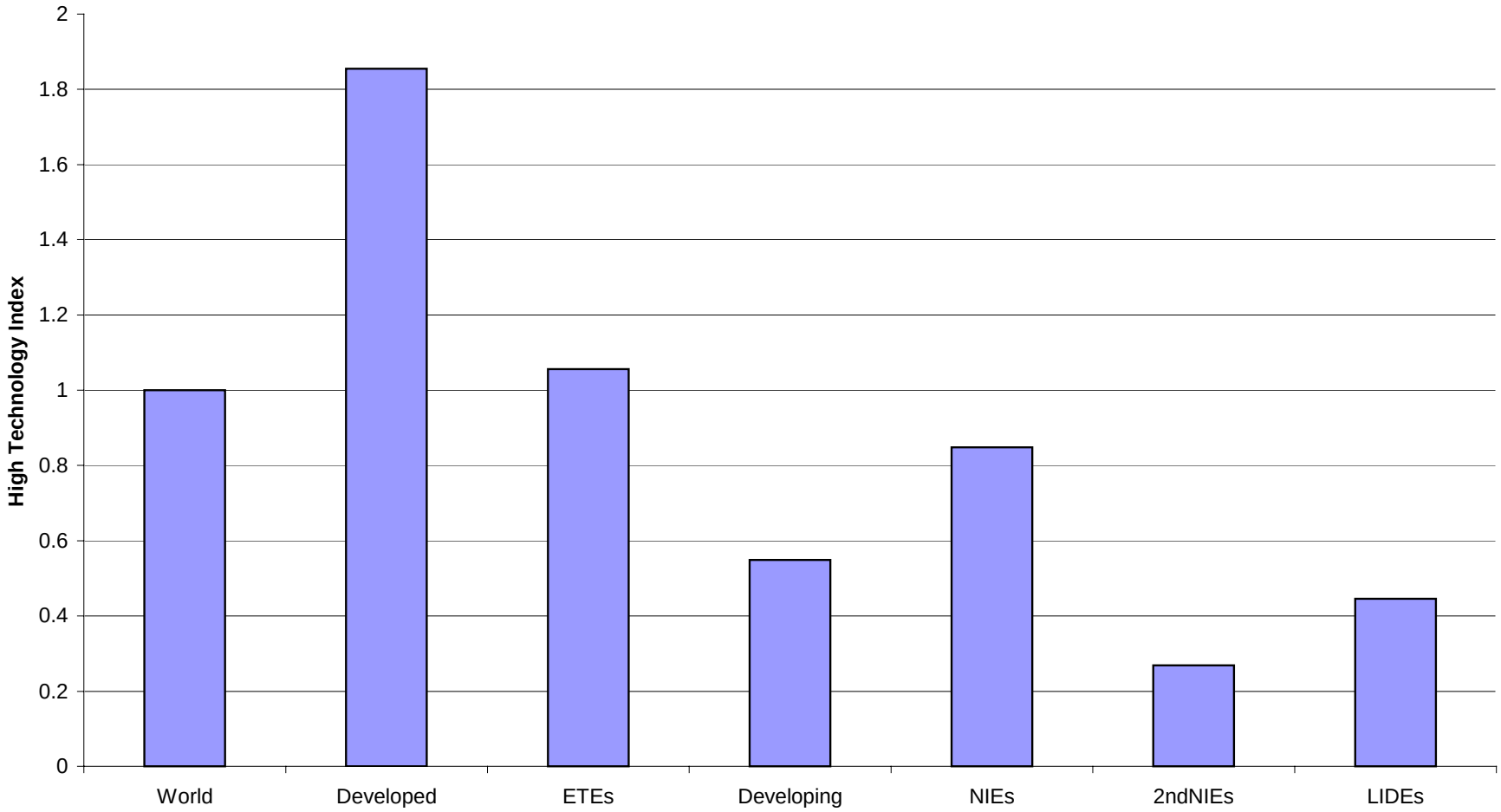
Table 2: High Tech Infrastructure Index, 1991-97

Economy	HII	Economy	HII
Argentina	0.43	Kyrgyz Rep.	0.29
Australia	2.11	Latvia	0.58
Austria	1.35	Lithuania	1.02
Azerbaijan	0.66	Madagascar	0.04
Bangladesh	0.03	Malaysia	0.13
Belarus	1.33	Mauritius	0.33
Belgium	1.64	Mexico	0.23
Bolivia	0.25	Moldova	0.47
Brazil	0.32	Netherlands	1.84
Bulgaria	0.86	New Zealand	1.13
Burkina Faso	0.05	Norway	2.07
Canada	1.82	Pakistan	0.22
Chile	0.47	Philippines	0.16
China	0.47	Poland	0.88
Croatia	1.21	Portugal	0.74
Cuba	1.00	Romania	0.86
Cyprus	0.17	Russia	1.53
Czech Republic	1.04	Rwanda	0.03
Denmark	2.14	Senegal	0.00
Ecuador	0.05	Singapore	1.39
Egypt	0.27	Slovak Rep.	1.20
Estonia	0.92	Slovenia	1.56
Finland	2.40	South Africa	0.73
France	2.10	Spain	0.93
Germany	2.24	Sweden	3.26
Greece	0.52	Switzerland	2.40
Hungary	0.74	Syria	0.07
Iceland	2.17	Thailand	0.10
India	0.28	Togo	0.19
Iran.	0.45	Tunisia	0.17
Ireland	1.66	Turkey	0.31
Italy	1.47	Uganda	0.09
Japan	3.18	United Kingdom	1.88
Korea, Rep.	2.14	United States	2.67
Kuwait	0.16	Venezuela	0.27

Note: High Technology Infrastructure Index (HII) calculated using the formula $[I_j(\Sigma I_i)^{-1}Sj(\Sigma S_i)^{-1}n^2]^{1/2}$ where the variables I and S refer to equally weighted country figures of R&D investment in Gross National Investment and R&D scientists and engineers per million people respectively, the subscripts $_j$ and $_i$ refer to country j and i and n the number of countries used.

Source: Computed from World Bank Institute (2001) data.

Figure 2: High Technology Infrastructure Index, 1991-97



Residents Patents

Patents offer neither an exhaustive measure of the technological capability of economies, nor are they the only instruments to measure innovative activities. Nevertheless, patents remain the most comparable means of demonstrating firms' and economies' innovation capabilities. Hence, this section uses residents patents as a means to show the innovative capability of economies, albeit not exhaustively.[42] To show domestic innovation capabilities, only patents registered by residents were used. The focus only on residents' patents will also eliminate much of the problems associated with double counting. Two indexes were calculated, the residents patent index (RPI) and the RPI*. RPI uses residents patents per million people while RPI* uses just residents patents. These indexes have another shortcoming in that they do not distinguish between a superior higher rent or useful patent from others so that economies with higher numbers of registered patents will figure more prominently than economies with fewer but far more significant patents, which might explain why the RPI for Japan and the Republic of Korea exceeded that of the United States. Nevertheless, the US ranked second in the RPI*. The RPI is preferred over the RPI* because of the focus on average innovative capabilities. The main use of the RPI is to denote the average individual and groups of economies' incidence of resident patents against the global mean.

The residents patents index (RPI) of the developed economies far exceeded that of the developing economies (see Figure 3).[43] However, the gap between the European transitional economies and the developing economies was very small. It shows that the high tech infrastructure of the European transitional economies – with the exception of a few - was neither strongly directed towards consumer goods nor utilised efficiently. Only the Czech Republic showed a high RPI figure. Slovenia, Russia, Croatia and Belarus were the other European transitional economies that showed appreciable RPI figures (see Table 3). In fact, the Soviet legacy of funding prioritised research led to the Russians holding considerable patents in the transitional economies. These activities have been declining following subsequent cutbacks in funding.

The NIEs show relatively high RPI figures (see Figure 3). However, the picture is mixed. The Asian first-tier NIE of Republic of Korea and Israel show a high RPI figure of 6.85 and 2.69 respectively, while Hong Kong and Singapore had figures of 0.12 and 0.51 respectively. Hong Kong and Singapore are tiny city-states and continue to remain bastions for MNCs seeking

[42] The use of patents registered in the United States was dropped because of the biased skew against patent-seekers abroad.

[43] While Japan and the republic of Korea show higher RPI figures than the US, it is generally taken that the latter produces more path-breaking innovations that generates higher rents.

patents. Singapore has managed to raise its RPI figures following efforts to support R&D activities domestically (see Wong, 2001). However, Singapore remains far behind Ireland, which has a similar population size and strong emphasis on MNCs. The Latin American first-tier NIEs of Brazil and Mexico had low RPI figures of 0.10 and 0.03, while Turkey had a figure of 0.03. Hence, in terms of residents' innovations, Korea and Israel rank high, but Mexico and Turkey show levels similar to the second-tier NIEs.

A number of first-tier Asian NIEs' firms are at the technology frontier – but remain competitively positioned in high volume low margin product technologies. Examples include Samsung's expansion into memory chips and washing machines, and Acer into computers. Samsung, Hyundai and Acer are a handful of firms that are engaged in new product development, but the variety of new products launched in these economies remain limited when compared to the United States and Japan.[44] Patent provision in Korea is highly concentrated while it is more dispersed in Taiwan. Nevertheless, in the Republic of Korea the share of patents applications filed by residents is high, which accounted for 58.3 percent of total patents in 1999 (see Rasiah, 2001).[45] Given that patents in Korea are primarily privately held, it reflects a strong development of Residents designing capabilities. Its high share of patents registered by residents is backed by a strong HII figure. The same can be expected of Taiwan. With stronger domestic capabilities, Korea and Taiwan quite clearly stand out among the NIEs.

The second-tier NIEs average RPI figures is lowest among the groups shown in Figure 3. China had the highest figure of 0.07 in this group. The Southeast Asian second-tier NIEs of Malaysia, Philippines and Thailand had low RPI figures of 0.05, 0.01 and 0.05 respectively (see Table 3). The Latin American second-tier NIEs of Argentina and had RPI figures of 0.12 and 0.06 respectively. Hence, although the second-tier NIEs have industrialised rapidly, they are still not ready to appropriate benefits from protection under the TRIPs agreement and make the transition to higher value added activities. Argentina's HII figure is likely to continue the decline as a consequence of chronic financial problems. Nevertheless, their strong basic infrastructure offers them the capacity to strengthen compliance.

LIDEs in Asia, Africa and Latin America had RPI figures dipping below 0.06 (see Table 3). Some of these economies had BII figures exceeding the global mean. Examples include Jamaica, Ecuador, Panama and Uruguay suggesting that good basic infrastructure is a necessary but not a sufficient condition for supporting innovative activities. In fact Uruguay had an excellent BII figure of 2.10 but its RPI figure was 0.05.

[44] The frequency of patents filed in Korea is high, though it is largely done by a handful of firms (see Mani, 2001).

[45] Data for Taiwan was unavailable.

Some LIDEs lacked the basic and high infrastructure as well as the innovative capabilities, but have been generating generic patents from the use of process-based patent laws. Examples include India, which had a RPI figure of 0.01. India even engages in the TRIPs agreement actively. However, Indian companies holding process-based patents will have to do away with them by 2006. Several Indian pharmaceutical companies will be affected as a result.

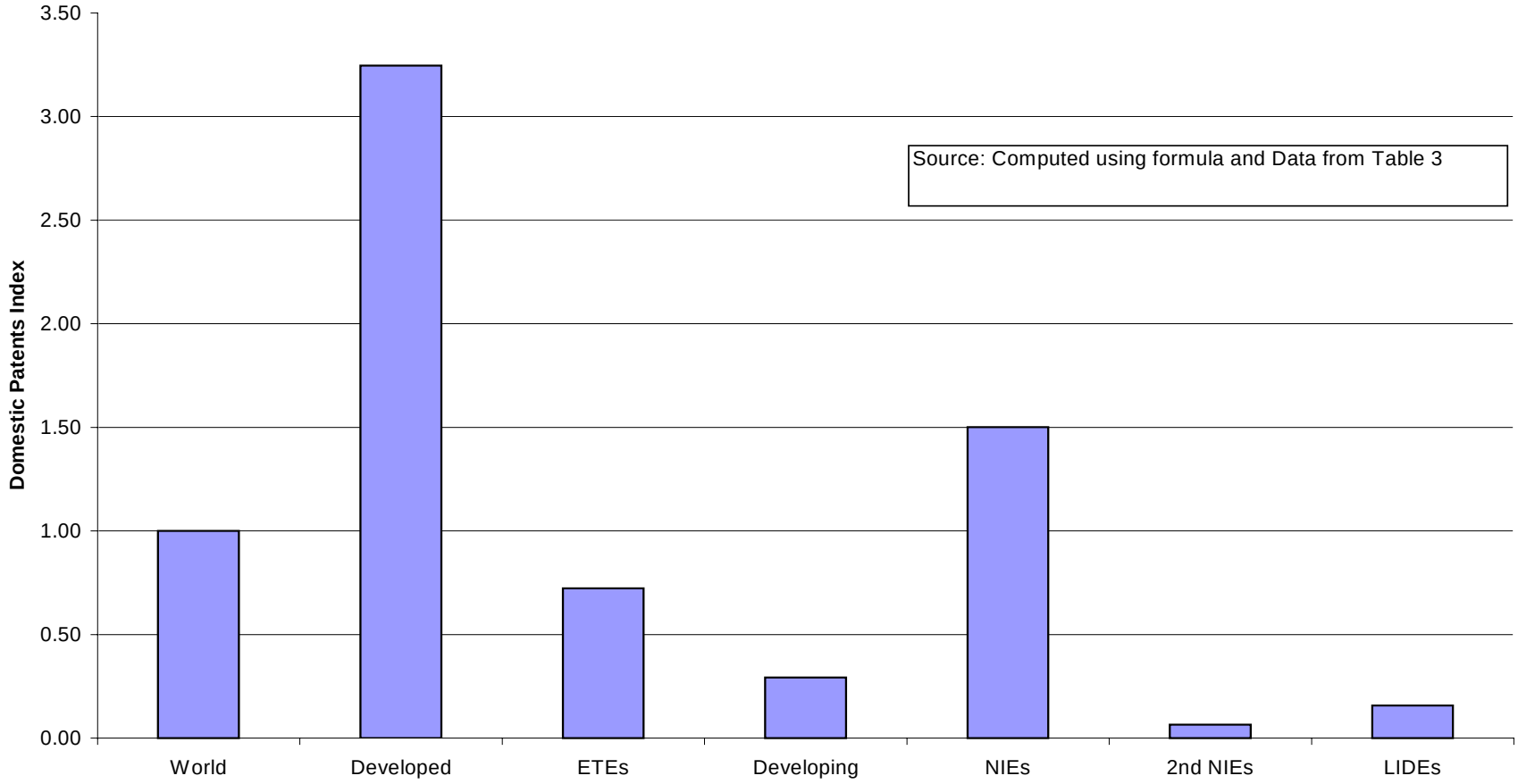
Table 3: Residents Patents Index, 1999

Economy	RPI*	RPI	Economy	RPI*	RPI	Economy	RPI*	RPI
Argentina	0.12	0.15	Guatemala	0.00	0.01	Norway	0.22	2.39
Armenia	0.01	0.13	Haiti	0.00	0.00	Pakistan	0.00	0.00
Australia	1.23	3.12	Honduras	0.00	0.01	Panama	0.00	0.07
Austria	0.41	2.43	Hong Kong	0.02	0.12	Peru	0.01	0.01
Azerbaijan	0.00	0.00	Hungary	0.10	0.48	Philippines	0.02	0.01
Bangladesh	0.00	0.00	Iceland	0.01	0.96	Poland	0.33	0.40
Belarus	0.12	0.60	India	0.29	0.01	Portugal	0.02	0.08
Belgium	0.26	1.21	Iran	0.05	0.03	Romania	0.18	0.38
Bolivia	0.00	0.01	Iraq	0.01	0.02	Russia	2.25	0.74
Botswana	0.00	0.03	Ireland	0.16	2.08	Saudi Arabia	0.01	0.01
Brazil	0.34	0.10	Israel	0.34	2.69	Singapore	0.04	0.51
Bulgaria	0.04	0.22	Italy	0.43	0.36	Slovak Rep.	0.03	0.27
Burundi	0.00	0.00	Jamaica	0.00	0.02	Slovenia	0.04	0.97
Canada	0.65	1.03	Japan	48.70	18.49	South Africa	0.75	0.86
China	1.89	0.07	Kazakhstan	0.17	0.54	Spain	0.42	0.51
Colombia	0.01	0.01	Korea, Dem.	0.00	0.00	Sri Lanka	0.01	0.03
Congo Dem..	0.00	0.00	Korea, Rep.	6.85	7.03	Swaziland	0.00	0.04
Croatia	0.04	0.62	Kyrgyz Rep.	0.02	0.15	Sweden	1.16	6.31
Cuba	0.01	0.16	Latvia	0.03	0.52	Switzerland	0.81	5.49
Cyprus	0.00	0.00	Libya	0.00	0.01	Syria	0.01	0.02
Czech Rep.	0.09	5.48	Lithuania	0.02	0.24	Tajikistan	0.01	0.04
Denmark	0.39	1.83	Luxembourg	0.03	3.58	Thailand	0.06	0.05
Ecuador	0.00	0.00	Macedonia	0.01	0.27	Trinidad & Tob.	0.00	0.09
Egypt	0.07	0.05	Malaysia	0.02	0.05	Tunisia	0.01	0.03
El Salvador	0.00	0.00	Malta	0.00	0.14	Turkey	0.03	0.02
Estonia	0.00	0.10	Mauritius	0.00	0.02	Turkmenistan	0.01	0.06
Ethiopia	0.00	0.00	Mexico	0.06	0.03	Ukraine	0.72	0.69
Finland	0.65	6.03	Moldova	0.03	0.39	United Kingdom	3.90	3.15
France	2.74	2.25	Monaco	0.00	5.07	United States	19.10	3.30
Gambia	0.00	0.03	Mongolia	0.02	0.40	Uruguay	0.00	0.05
Georgia	0.04	0.33	Morocco	0.01	0.02	Uzbekistan	0.10	0.19
Germany	9.16	5.36	Nepal	0.00	0.00	Venezuela	0.03	0.06
Ghana	0.00	0.00	Netherlands	0.78	2.36	Vietnam	0.00	0.00
Greece	0.01	0.04	New Zealand	0.18	2.31	Yugoslavia	0.07	0.32
Grenada	0.00	0.00	Nicaragua	0.00	0.02	Zambia	0.00	0.00

Note: Residents Patents Index (RPI) calculated using the formula $P_j((\Sigma P_i)^{-1}n$ where P refers to residents registered patents per million people, the subscripts j and i refer to country j and country i, and n the number of countries used; RPI* uses just residents patents.

Source: Computed from World Bank Institute (2001) Data.

Figure 3: Domestic Patents Index, 1999



However, most of the remaining LIDEs neither demonstrate the infrastructure support – basic and high tech - institutions nor the innovation capabilities to facilitate technology development (see Table 3).[46] The TRIPs agreement is likely to force them to divert scarce resources to meet enforcement conditions. For a number of these economies the problem is not much related to supporting firms develop or imitate product technologies to compete but rather to protect foreign patents from being infringed by illegal operatives. For these poor economies, scarce government finances may be diverted to protect foreign private property rights rather than for meeting domestic needs. Neither the demand nor the supply capabilities exist in these economies to worry as yet about seeking cheaper foreign technology.

The different technological support and innovative capabilities of developing economies generate different implications under the TRIPs agreement. Institutions and firms in first-tier Asian NIEs are relatively better positioned to compete under the TRIPs agreement. With the exception of Indonesia and Philippines, the second-tier Asian NIEs have the basic infrastructure to comply with the TRIPs agreement, but seriously lack the high tech infrastructure to support innovative activities. China and to a less extent Argentina are the only exceptions. However, both economies still had very low RPI figures in 1999. Most LIDEs have neither the basic infrastructure to enforce compliance nor the high tech infrastructure to benefit from the TRIPs agreement. Technology transfer involving product and tangible process technologies will become more difficult under the agreement. Intangible technical and management processes still lie outside IPR regimes and hence should not affect latecomer firms.

[46] See Lall (2001) for an incisive account of the capability deficiency problems developing economies face in their attempt to seek insertion in a liberalising world.

5 CONCLUSIONS

It can be seen that the TRIPs agreement addresses several instruments and is far more complex than simply equating it with the debate between regulation and deregulation, and its contestations are still inconclusive. There are strengths and weaknesses associated with those calling for regulation and those against it. Free trade may not guarantee the optimisation of intellectual property creation, and greater access and better distribution. Without socially accountable multilateral governance, free trade conditions may degenerate and exacerbate concentration tendencies and oligopolistic conduct so that much of its purported advantages would not be realised. However, interventionist IPRs themselves may generate sub-optimal outcomes as the dominant interests enjoying market leadership could aggravate further technological imbalances facing the dominated groups. Both prescriptions could produce concentrated markets with monopoly conduct so that the prospects of technological capability building among the poorer economies look bleak with or without currents forms of regulation.

The application of private property rights to intellectual goods and services also often conflict with systemic and spillover aspects of knowledge, and public and basic needs' goods. The first views knowledge as having path-dependent network dynamics that when driven across society will raise the productive capabilities of all agents to expand systems synergies. Network cohesion improves with greater flow of knowledge. The second addresses the public characteristic of knowledge and the societal properties of basic goods so that its appropriation is dispersed to all corners of society at optimum costs. Since basic and blue-sky research is generally publicly funded, it should form the basis for greater access to the public. The case becomes even stronger when involving basic needs goods. LIDEs and the disadvantaged across the world (including in developed economies) require greater access to basic needs' goods (including critical drugs) – which in the past were delivered either through subsidies, price control or anti-trust measures and greater competition.

Developing economies comprise of a diverse set of economies with wide differences in their basic and high tech infrastructure and innovation capabilities. The paper showed that economies with strong innovation incidence as shown by the number of patents registered per million people domestically, also had strong BII and HII indexes. However, the converse did not hold, suggesting that BII is a necessary but not a sufficient condition for innovation. Economies with high RPI figures also enjoyed high HII figures. The LIDEs in particular are seriously disadvantaged as they lack the high tech infrastructure to participate actively in the innovation process. While most of these economies have yet to install even adequate basic infrastructure,

the TRIPs agreement stands to deny them the opportunity to absorb the requisite knowledge – involving product and tangible process technologies - cheaply to stimulate capability building.

The NIEs have the institutions to meet the TRIPs obligations, and the Republic of Korea and Israel are strategically positioned to move to the technology frontier. However, Brazil, Mexico and Turkey lack the high tech infrastructure to make the transition. The second-tier NIEs enjoy the basic infrastructure to ensure compliance, but lack the high tech infrastructure to participate actively in the innovation process. Argentina's relatively stronger high tech infrastructure has continued to decline following chronic financial problems, while Venezuela has yet to install the requisite institutions to stimulate strong participation in innovative activities. The second-tier NIEs of Asia managed to industrialise rapidly through the participation of foreign MNCs. However, their extremely low levels of high tech endowments have made them vulnerable. MNCs account for much of their high tech exports. China is the only exception where there is a steady growth in high tech institutional support to facilitate stronger RPI figures in future.

The poor LIDEs neither have the instruments to engender capability building fast enough to trigger a catch up with the developed economies, nor the financial might to erect governance instruments to honour TRIPs obligations. The primary concerns of many of these economies are related to generating basic infrastructure and hence efforts to install IPR mechanisms may undermine their capacity to achieve the former – thereby denying them the opportunity to create any synergy at all for technology capability building domestically.

The TRIPs agreement relating to patents – particularly on software (including copyrights involving computer programme) would be extremely hard on the developing economies. However, given the heterogeneity of IPR instruments and the importance of protecting the intellectual property of the developing economies, copyrights could play an important role if it is confined to the spirit of the Berne Convention. Literary and work of art are generally the product of artisans and individuals, which do not overlap with public utilities and basic needs' goods. The application of these procedures will help rather than harm the evolution of literary and other works of art and culture.

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