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Trade-related Intellectual Property Rights for Genetic Resources: Implications for Developing Countries

INTRODUCTION

The Uruguay Round of the General Agreement on Tariffs and Trade (GATT) negotiation – which more than 120 nations completed on 15 April 1994, in Marrakesh, Morocco – includes a unique provision regarding establishment of global intellectual property rights (IPR) for technology involving all forms of life, including plants, animals and micro-organisms. This provision calls for a major change in the patent laws that exist throughout the world today. Many developing nations currently do not recognize any form of patent on biological resources and related technology. It is expected that it will take more than a year for all the GATT signatories to ratify the agreement in their individual countries by including patent protection on plant- and animal-based technology.

The proposal to introduce IPR into the GATT framework has evoked stiff resistance from farmers and plant breeders around the world. Farmers and breeders think biological resources and plant-based technology are essential to their economic self-reliance. Thus they fear that conferring intellectual property rights on these inputs to international firms will have adverse consequences for themselves in general and for research and development in agriculture in particular. However, countries which refuse to adopt this GATT provision could face international trade sanctions.

This paper will critically examine the social, economic, legal and resource-preservation implications which enforcement of IPR provisions may have on the public, governments, scientists and future generations in developing countries. The first section discusses general arguments for and against establishing a system for dealing with intellectual property rights. That is followed by an explanation of the mechanism of the new trade-related intellectual property rights (TRIPS) and how that differs from existing patent laws. A further section discusses the implications of TRIPS for various types of biological and genetic resources in developing countries, and the paper ends with discussion of policy options and provides some conclusions.

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ECONOMIC ARGUMENTS ABOUT INTELLECTUAL PROPERTY RIGHTS

Owing to increasing population and the scarcity of any given nation's resource endowments, a constant flow of knowledge-based innovations which substitute human intelligence for scarce resources is essential for steady economic growth. New processes and products created through these innovations provide new opportunities for economic activity, promote income and employment growth, and improve overall standards of living. New technology is becoming increasingly intellectual rather than material in nature (Sen, 1993). The development of new sources of production material, energy substitutes, computers, efficient industrial equipment, chemicals based on renewable resources, and biotechnology are some examples of technologies with a high degree of intellectual content.

To encourage the flow of intellectual innovation, its developers need to be assured that a mechanism exists to reap financial returns from their investments. Profiting from an innovative technology is possible only when its innovators or developers have exclusive monopolistic rights to make, use and sell products resulting from their developmental efforts. Governments grant these exclusive rights to allow the original inventor or right holder to receive adequate financial incentives for investing resources in the research, development and commercialization of that innovation for the common benefit of society.

The costs of research and development, especially in the area of biotechnology, are substantial. Industrialized countries argue that intellectual property rights must be respected to provide a fair return to the private investors who take the substantial risks involved in developing and commercializing a new technology (Mansfield, 1990). However, there is no standardized intellectual property protection like patents, copyrights and trademarks across nations. In particular, many developing countries do not recognize intellectual property rights protection in biotechnology, yet these countries are favourite business places for the industrial nations. Without adequate IPR protection, industrialists from developed countries fear that competitors in developing countries will pirate away their inventors' profits without reinvesting in further research and development. The original inventors from developed countries, unable to earn adequate profits from their investments, have less incentive to perform further research and development. Thus the future of technological development would diminish worldwide. Though there may be a short-run loss in the developing countries from establishing intellectual property rights, by way of lost jobs and decreased production of patented products, those countries will benefit in the long run through increased research activities and technological advancement.

Developing countries, on the other hand, argue that IPR gives patent holders undesirable monopolies on advanced technology which can be used to extract unjustifiably high prices and unwarranted restriction on the application of a technology. The overall development in developing countries may be hampered for want of access to a protected technology. In the short run, discontinuing protected products will dislocate industries in developing countries. Even

in the long run, as claimed by developed countries, protecting IPR will not promote investment in indigenous technology because developing countries lack fundamental prerequisites – monetary funds, research facilities, and scientific and technical personnel. Thus they may be deprived of both short-run and long-run benefits of protected intellectual property rights.

The proposal to extend IPR particularly to plant-based and biotechnologically produced products has been strongly criticized, especially in India. Kothari (1992) argues that, throughout history, biological species, technologies and the knowledge related to them have been exchanged freely between societies and individuals, resulting in an all-round enrichment. Developed countries must allow free access to the biotechnology arising from the resources and knowledge obtained from developing countries. Millions of people in developing countries depend on plant and animals and the indigenous technology based on them in their day-to-day life. Therefore it is unethical to patent any life forms and technology related to such resources (Shiva and Holla-Bhar, 1993). The opponents of IPR perhaps want to view its enforcement as little more than intellectual colonialism.

TRADE-RELATED INTELLECTUAL PROPERTY RIGHTS

Currently, international norms governing intellectual property rights are embodied in a series of international agreements administered by the World Intellectual Property Organization (WIPO). Until recently, under the terms of the 1983 Paris Convention, it was accepted that different countries have different needs and priorities; each country is allowed to formulate its own patent laws (Shiva and Holla-Bhar, 1993). However, developed nations argued that, without adequate intellectual rights, protection is unfair and unjustifiable. In the early 1980s, several industrialized nations put tremendous pressure on WIPO to formulate uniform patent laws around the world. Primarily developed, industrialized countries signed these WIPO agreements, but the organization has no enforcement mechanism against IPR violators.

For this reason, the developed countries resorted to the GATT in the recently concluded Uruguay Round. GATT has an inherent mechanism – trade sanctions – of punishing the violators of its agreements. Rules governing international trade are embodied in the GATT agreements and have been refined and developed through successive rounds of negotiations, with the ultimate goal of eliminating barriers and distortions to international trade (Gadbaw and Gwynn, 1988). On the grounds that inadequate IPR serves as a non-tariff trade barrier, it is argued that all countries in the world must adopt common intellectual property rights laws. Thus, in the Uruguay Round, IPR was linked for the first time with international trade to become what are known as trade-related intellectual property rights (TRIPS).

Several TRIPS provisions differ dramatically from some of the patent regulations prevailing in developing countries and restrict the way farmers and local people have traditionally utilized biological and genetic resources.

Product versus process patents

TRIPS completely eliminate process patents and allow only product patents, whereas many developing countries currently have only process patents. Product patents may hamper the development of better, cost-efficient technology in both developing and developed worlds. This is a disincentive for other innovators to develop cheaper technology to produce patented products. For example, the US subsidiary firm of W.R. Grace, Agracetus Inc., has acquired US patents for all of its genetically engineered cotton varieties until 2008, and it also has patents pending in other countries. Now all transgenic cotton products, regardless of which engineering technique is used, will have to be commercially licensed by their company.

Patents on living organisms

All subject-matter, including living organisms, is patentable. Thus farmers saving patented seeds for subsequent years from a current year's crop will have either to pay royalties to the patent holders or to purchase new seeds every year. Small farmers will find it very expensive to do so. The sale of seeds between farmers, which is generally inexpensive, will have to stop. This could hamper sustained adoption of new seed varieties in rural areas. Plant breeders also must purchase the protected seeds for further research from the patent holders.

The new category of biofertilizers and biopesticides which are becoming popular, and are based on living organisms such as algae, bacteria and small plants, will also come under the purview of IPR and become monopolized. For instance, some US and Japanese companies have patented 12 extracts of *neem* plants which can be used as biopesticides and herbal medicines (Shiva and Holla-Bhar, 1993). These companies are also applying for product patents on these extracts in other countries. *Neem* and its products have been considered a symbol of indigenous knowledge and have been developed by common people over many centuries in India. The plant is used for herbal medicines, toiletries, contraception, timber, fuel and pesticides which are effective for more than 200 insects. Considering *neem* products common property, the Indian Central Insecticide Board has not registered them under the Insecticides Act. If international firms can obtain product patents on some *neem* products which might be very similar to indigenously produced *neem* products, local users may lose access to their own indigenous technology. This potential threat has led to violent and angry demonstrations by farmers all over India in recent years. Further, the new international market for *neem* has resulted in a sharp increase in the *neem* seed prices from Rs 300 per tonne to Rs 3000–4000 per tonne over a period of 20 years. The local users may find it extremely expensive to buy for their use.

Longer term of patents

The general term of a patent under TRIPS is extended to 20 years – a longer period to recover monopoly rents from a protected technology or product. It is possible that a patented technology may become outdated by the end of the patent's term, and thus domestic producers may be permanently deprived of this technology.

Removal of non-working clause

A patent cannot be revoked for non-working. It often happens that patent holders do not commercialize a newly developed innovative product or production technology in order to recover returns from their current investment on previously patented products. Such action will deny society the opportunity to make use of an innovation.

Unlimited royalty

No ceiling must be placed on a royalty demanded on patented products. Patent holders may charge undesirably high monopoly royalties for sale or access to such technology. For example, opponents of TRIPS fear that multinational seed companies could charge farmers high prices for using second- and subsequent generation seeds produced from a patented seed stock.

Burden of proof

TRIPS also reserve the burden of proof. Under the current system, the patentee has to establish a *prima facie* case that his patent has been infringed. Under TRIPS, the patentee just has to accuse a person of patent infringement and the party so accused will have to prove that he did not infringe the patent. In agriculture and other sectors where a large number of domestic manufacturers are involved, the government responsibility for enforcement and settlement of legal suits can be enormous.

SOCIOECONOMIC AND ECOLOGICAL IMPLICATIONS OF TRIPS

The impact of TRIPS on the use and stock of a country's biological resources will depend upon the kind of resources in question, the nature of their use and the values which people place on them. For this discussion, we can classify these resources in the following manner: physically non-extractable resources, physically extractable resources under current use and physically extractable resources with potential future use.

Physically non-extractable resources – plant genes, bacteria and other microbes – can be exploited for their intrinsic non-tangible values or attributes

without being physically exhausted in the process of exploitation or use. Extractable resources under current use are those which are being physically extracted and are renewable, but can be completely exhausted if the rate of exploitation continuously exceeds the rate of regeneration. Many extractable resources and technologies based on them are in the 'under current use' category. The third category of resources are those which may not have any use or value at present but may have future potential uses. Such resources might be unintentionally exhausted or destroyed in the process of forest clearing, river damming and other land-based activities for a variety of purposes.

Non-extractable resources

Consider the example of the genetic seed materials which played a crucial role in the 'green revolution' of the 1970s throughout the world's agriculture. Genetic resources are primarily concentrated in Third World countries, and many modern varieties of crop species are developed from genetic materials collected from farmers' fields. Even farmers have discovered thousands of useful plant varieties and germ plasma from the wild, and they have selected improved material over the course of centuries. Currently, several international crop research organizations have established gene banks from the genetic material once found in the farmers' fields. Recent biodiversity conventions and TRIPS consider generic materials the common heritage of humankind and attempt to eliminate any national sovereignty over them (Sen, 1993).

TRIPS require that all countries provide protection to plant varieties either by patents or by another effective *sui generis* system. The existing *sui generis* system is one of plant breeders' rights (PBR), which operate only in developed countries and which confer upon the holder the exclusive right to produce seed of the protected variety for the seed trade and control of seed marketing. As a result of TRIPS, many commercial high-yielding seed varieties will become patented, a development which will not allow even plant breeders to use protected seed for further research on varietal development. Nor does it allow farmers to save a protected seed variety from a current year's crop and use or sell it as seed stock in the subsequent years. For instance, almost 60 per cent of seed requirements in India is met by sales between farmers (Sahai, 1993). It is feared that, over time, multinational seed companies will slowly patent most useful genetic seed materials which exist in the international gene banks. Local farmers may lose incentives to innovate and develop locally adaptable, disease- and pest-resistant varieties.

In countries which do not recognize patent protection on high-yielding and hybrid varieties, many seed varieties developed as a result of publicly funded research have remained unprotected. If these varieties are similar to those developed by international firms, countries could lose the benefits of domestically funded research to those international firms if they are slow to seek their own patents. Many developing countries have been very successful in the 'green revolution' during the past few decades. Over this period, their agricultural production has multiplied several times, and food prices have declined dramatically. Opponents of TRIPS argue that protecting seed technology through

TRIPS could increase production costs, put many small farmers out of business, reduce a nation's overall food production and increase the food prices. But, in reality, seed cost constitutes an insignificant portion of total production costs. A TRIPS-related increase in the price of genetic seed material supplied by the international firms may not pose a major threat to the sustained adoption of high-yielding varieties. Higher seed costs, however, may affect small and marginal farmers. But these farmers generally own only a small portion of the total agricultural land. Big farmers, perhaps, could easily absorb this price increase. As a result, the view that sustained adoption of high-yielding seed technology in developing countries would be negatively affected by TRIPS may be a myth rather than a reality.

Currently extracted resources

There may be many indigenous biotechnologies which are commonly associated with biological resources in developing countries. Some have been developed as a result of common knowledge over centuries, and others have been developed by domestic research efforts during the post-colonial era. As mentioned earlier, *neem* is a good example of this. Another example of this resource category is the African soapberry, or *endod*, a very common plant which has been used for centuries in many African countries for a variety of purposes, including insecticidal soap, fish intoxicant and spermicidal contraceptive (Shiva and Holla-Bhar, 1993). In the early 1960s, African scientists found that *endod* has the ability to kill water snails, which are the only vector of the disease, bilharzia. Prompted by this research, the Tropical Products Institute in Britain subsequently patented an *endod* extraction process without acknowledging the African scientists who originally reported the *endod's* chemical potential. This extract was found to be particularly effective in killing zebra mussels which clog North American water pipes and disrupt US fisheries. Some commercial firms are attempting to prospect from this extraction. Holding patents for *endod* extraction, these firms could eventually capture the African *endod* market for commercial production of the molluscicide for the North American countries. If this occurs, the people of African countries will not receive any royalties and may eventually lose free access to this plant as a result of market competition between local and international consumers, plus commercial patent protection prohibiting local use.

Such competition, apart from driving local consumers from the market, has serious implications for the long-term preservation of the biological species in question. Studies of renewable resource economics (Clark, 1976; Cropper, 1988) have identified situations under which the owner of a renewable resource would find it more profitable to harvest a resource stock to its extinction than to follow a long-term, sustainable harvesting strategy. One of these situations occurs when the existing stock of a resource is very near or below a minimum threshold level of stock. For such a low stock, the time required to build the stock up to a level where substantial profits are earned is so great that an extinction strategy yields higher discounted benefits.

The level of minimum threshold relative to the existing stock level of a given biological resource will depend upon the profitability of that resource.

Suppose that a biological species which has a moderate economic value for local users is found by an international firm to possess a high-value chemical extract. Then the threshold levels of this resource level will differ between the two users. The international user who attaches a higher market value to this resource will have a lower threshold level and find it profitable to conserve even at a very low stock and to harvest on a sustained basis. On the other hand, local users who value this stock at a moderate or low level may have a higher threshold level. Thus the current stock must be at a relatively high level for the local users to adopt a sustainable harvesting strategy instead of a resource exhaustion strategy.

Protection of IPR for a product derived from such biological resources will increase the profit potential of the international user and restrict or eliminate profits earned by traditional users. As a result, the minimum threshold level of this resource for the international firm will decrease while that of local users will increase. If the threshold level of local users exceeds or approaches the existing stock level, local users who are closer to the resource base could start overexploiting the stock. Thus the effect of TRIPS on a resource which is currently under use by a local community is to expose the existing resource stock to a greater risk of optimal exhaustion.

Resources of potential future use

Certain biological resources are currently being screened for their potential as high-value products – medicines, insecticides and other industrial chemicals. These efforts are still far from producing commercially viable products. These resources (such as wild genes) currently have no market value for local users, though they may have a potential value for the global community. Many are being destroyed unintentionally at no financial cost as a result of population pressure and agricultural development. For example, Indonesia was expected to clear 1.5 million acres of tropical forest to grow soybeans; Thailand has deforested 10 million acres for low-yield farming in recent decades (Avery, 1991); about 18 million hectares of Amazonian forest have been cleared in Brazil to meet the European and American coffee demand (Schucking and Patrick, 1991).

Patenting products and processes of such genetic resources may give adequate incentives for the transnational firms to invest in additional research and development and to make payments to the governments or agencies of developing countries to preserve their biodiversity.[1] Such payments may be spent to develop alternative production and employment opportunities for those who otherwise would resort to destruction of the potentially useful resource base. However, creating markets for such resources alone will not preserve them. Even with positive market prices, resources under open-access property regimes will be subject to overexploitation if the market price exceeds the costs of harvesting at low levels of resource stock.

Tropical forest lands, although covering only 14 per cent of the earth's land surface, host possibly 90 per cent of the world's total species (Flint, 1993). A single hectare of rainforest can contain up to 300 tree species, whereas the

whole of continental North America hosts 700 species. Much of this tropical forest land is under constant threat of conversion to farm land, residential area and roads, and some is being submerged by irrigation reservoirs. Wilson (1988) estimated that 10–20 000 species are becoming extinct every year. Therefore it is important for the countries in question to reverse the trend of declining biodiversity and to re-evaluate the needs of the current generation *vis-á-vis* the global community and their own future generations. Extending intellectual property rights protection to international firms which might restore a market value for resources which have no local value may help the cause of preserving biodiversity.

POLICY RECOMMENDATIONS AND CONCLUSIONS

Since the impact of TRIPS varies with the type of resources discussed, the most appropriate policy for developing countries may be to adopt a pluralistic approach by extending a different degree of protection to each resource category. Since the costs of hybrid seeds are not a major component of crop production costs, agricultural seeds may be protected to encourage international firms to develop and supply new seeds. While international firms may be provided protection on their seed material, governments also may encourage domestic plant breeders to obtain patents on hundreds of seed varieties which they claim to have developed from public research or common knowledge. Small and marginal farmers may be affected by patenting seeds but, since the area owned by small farmers is not substantial, governments may enter into discussions with seed companies to persuade them to supply seeds to these farmers at subsidized rates. The burden of proof of violation may not be left entirely to the farmers and the governments, since the number of farmers is large and could lead to endless litigation. Governments may in turn recover a portion of the litigation costs from seed companies.

Since extending full protection on currently extracted resources may deprive local users and create a scarcity of resource-based production inputs, and could expose the resource stock to a greater risk of optimal exhaustion, only a partial patent may be extended to such resources. One example of partial patent may be a process patent instead of a product patent. Further, all the biotechnologies and products related to such biological resources which are common knowledge must be identified and patented in the name of a state or federal government as a trustee of the common people. This option provides protection for local people on technologies they have been using for centuries. If the current level of a resource's stock is below or near the minimum threshold level, a government may impose a moratorium on harvesting the stock until it recovers to a level where it would be profitable for both users to resume harvesting.

A biotechnology, based on biological species, which is still under development may be given a full TRIPS protection. These resources may not have market value for the local communities but have high option and existence value and potential future market value for the global community. Therefore developing countries may want to view TRIPS as an opportunity rather than a

threat, and yield to the call from the international community to save such resources for adequate compensation. Creating a suitable patent system is a first logical institutional measure to attract international firms. Under this option, developing countries have to sacrifice the short-run benefit of economic development for potential long-run benefits.

This pluralistic option may not fully satisfy TRIPS proponents and international communities. Developing nations still might have to face some amount of risk of trade sanctions by GATT countries. However, GATT always has been an effective international forum of political and economic negotiation among trading nations, each representing the interest of its most powerful interest group at that time. In the Uruguay Round, trade interest groups may have emerged as clear winners. As GATT nations, over time, realize and learn from the likely adverse impacts of TRIPS on the environment, TRIPS may undergo changes to become environmentally more friendly in the future.

NOTES

[1]In recent years, a number of international firms have entered into contracts for the commercialization of genetic resources. For example, a US pharmaceutical company, Merck and Company, has paid an 'up-front' compensation of $1 million to a Costa Rican quasi-governmental organization, the Instituto Nacional de Biodiversidad, in order to oversee Costa Rica's biodiversity (Simpson and Sedjo, 1992). The contract also provides substantial future royalties if the US company develops commercially extractable products from the genetic resources of Costa Rica. Similarly, the US National Cancer Institute has contracted with agencies of Zimbabwe, Madagascar, Tanzania and the Philippines for access to their genetic resources.

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