

The Impact of Patent Law on Sustainable Development

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Abstract—This article explores the complex relationship between patent law and sustainable development, highlighting the potential for patents to both promote and hinder progress towards a more sustainable future. The study examines how patent law can incentivize innovation and investment in sustainable technologies, while also considering how patents can create barriers to access and dissemination of these technologies. The article also discusses the role of patent law in promoting global cooperation and technology transfer, as well as the potential for alternative approaches to intellectual property protection to better support sustainable development goals. Through a comprehensive analysis of the literature and real-world case studies, the article provides a nuanced understanding of how patent law can impact sustainable development and offers recommendations for policymakers seeking to balance the interests of inventors and society as a whole.

Keywords— Development, Patent Law and Sustainable

I. INTRODUCTION

Protection of intellectual property is a rapidly growing field with a great deal of international focus and debate. The establishment of the World Trade Organization (WTO) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) have thrown the subject into the forefront of international diplomacy. It is the latest international agreement that has led to pressure on many developing nations to increase the level of IP protection. This is of particular relevance when considering their economic, political, and social situation, to the point where the protection of IP rights takes priority over issues such as access to vital medicines for the public. The link between IP and sustainable development is an issue of two very different schools of thought. On one hand, it's evident that IP is an essential factor in the development of new technology, the creation of artistic works, and economic growth. This is a point that will be expanded upon later. On the other hand, the main goal of sustainable development is to ensure that the future offers an

improved quality of life for the coming generations. This aims to be achieved through careful consideration and often restriction of the use of natural and man-made resources.

This is in direct conflict with the unlimited nature of IP rights and the expectation that increased protection will provide further incentives to create and innovate. It also poses the question as to whether the costs of limiting IP to facilitate certain sustainable goals outweigh the benefits. It will be shown that this question is near impossible to answer in a general sense due to the vastly differing circumstances of nations and the wide scope of issues to which 'sustainable development' can refer (Athreye et al.2020). The broadness of this term must be considered from the outset, as seeking to minimize the impact of IP in a way that promotes sustainable development may involve measures in a wide range of areas such as health, environment, resource management, and culture.

1.1 OVERVIEW OF PATENT LAW

Granting patents provides inventors with an exclusive right to use or exploit their invention for a certain period, usually 20 years. This is intended to act as an incentive for investment in research and development (R&D) to further scientific and technological progress. By offering the opportunity to profit from an invention, it is thought that more innovations that are potentially beneficial to society will be made. The public disclosure of patented inventions is also valuable as it allows others to learn from the technology. This can be seen in pharmaceuticals, where detailed knowledge of a patented drug can be vital in enabling other researchers to develop more effective or cheaper alternatives (Kleine et al., 2022). While patents may directly encourage activities that are beneficial to the innovation and diffusion of technology, it is a generally held view that environmentally and socially beneficial inventions are not being given sufficient attention.

Patent law extends legal and policy regulation over the granting of patents, which are recognized as a form of intellectual property. The World Trade Organization's (WTO) Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement has assisted in creating a degree of international standardization in patent law. TRIPS sets minimum standards for many forms of intellectual property regulation, including patents. Members of the WTO are required to conform to the agreement. This means that patent law in many nations today accords with TRIPS. It should also be noted that there is much variation in patent law between nations and that the agreement is subject to future changes in intellectual property regulation.

1.2 DEFINITION OF SUSTAINABLE DEVELOPMENT

In trying to find a solution to the "tragedy of the commons", there has been a proposal for an alternative to both property rights and state ownership. In this suggestion, resources would be allocated within a communal transaction framework. An example of this was the proposal of an international wood preserve treaty in which an international organisation would issue permits to countries allowing them to harvest an allotted amount of timber within their borders. The organization would be the owner of the timber and the resource owners the "commoners". Although the proposal of this still has tones of a principal-agent relationship. This doesn't exactly parallel a patent, but it does carry some sort of an allocated temporary

monopoly. This method has been repeated throughout history in various forms and names but primarily it is all a way of allocating resources with exclusion in the most efficient way (Umetsu & Shirai, 2020). This is the very thing a patent looks to do, with a certain twist. Usually, the intention behind the patent is to seek high profits from the said resource, in comparison to developing an efficiently allocated resource to conserve. The point to be made here is that the theory behind a patent has been tried and tested for centuries, it is a way to allocate resources with exclusion and it has been seen as a successful way to do so.

1.3 IMPORTANCE OF STUDYING THE IMPACT

The third reason is that many critics of the patent system claim that it hurts development. If it is found that there are instances where this is true, it is usually in a situation where the patent system was implemented without consideration of its impact. If it can be shown that a well-designed patent system has a positive impact and how that impact can be achieved, this will provide valuable information for developing countries or countries with emerging technologies on how to tailor the system to their advantage.

The second reason is that the pace of technological development means that many countries are going to be novices in implementing a patent system for an emerging technology. A current example is the biotechnology industry where many countries are attempting to develop an industry using a variety of forms of government funding and regulation in an attempt to garner foreign investment. These countries will need to weigh up the costs and benefits of implementing a patent system for what is usually a technology with long-term uncertain profit potential. In doing so, they will need to make a comparison with the experiences of other countries and their biotech industries.

This topic is of crucial importance for various reasons. First and foremost is the fact that the number of countries that are attempting to implement sustainable development policies is increasing in an era where globalization is a key example the European Union. The EU has previously agreed to have all patents registered at the EU Patents Office (EPO) in a single language, an agreement that fell apart once they tried to decide on the language. The EU means that there will be more countries or regions with different levels of economic development implementing the patent system. This in

turn means that there needs to be a detailed study on whether implementing a patent system will take away R&D from the poorer countries and thus harm their economic advancement. If it is found that there are negative effects, then a system to mitigate this impact needs to be developed. This type of situation is exactly what is desired from a law and economics analysis, clear identification of a problem and its solution.

II. HISTORICAL BACKGROUND

There has been a growing recognition of "sustainable development" in various forms over the past few decades. Some would argue that the very concept of patenting an invention is a contradiction to sustainable development, where monocentric enterprises and exploitation of resources have become the norm for developed countries. The focus of a patent is to grant a monopoly right to the inventor to prevent intellectual property theft and to reap potential economic benefits. This has led to concern in many climate change and resource management fields where it has been noticed that there has been an absence of development in new clean technologies and environmentally friendly resources. This is due to a fear of potential future economic losses trying new technologies and an unwillingness to release current information that may be exploited by foreign competitors. Solely on the economic sense, it has been shown that most new technologies are not the most efficient tools in the short run and are economically unviable without subsidies of some form. These resources can also be developed in developing countries or be in use of technologies implemented in developed countries and never reach the public domain due to a lack of patent rights. This has led to an imbalance between the exploitation of resources and the benefits they can provide in the long run (Faujura et al.2021).

Patent law has been in existence since the 15th century when the Venetian Statute of 1474 granted an exclusive right to sellers of certain types of silk. This implemented direct control over the price of the object of their trade and attempted to eliminate unfair competition. The first complete statute made to regulate the patent system was passed in 1623 during King James 1st reign in England. This system has evolved into what is known today and has been adopted by almost all countries in the world, where the initial monopoly rights have been shifted towards disclosure of information to the public,

in return for a limited-term monopoly of exploiting the invention. This suggests that current patent systems of the modern world were invented to protect the rights of the inventor, for the greater benefit of the public. This notion has changed over the years and has invited criticism that patent law is aimed towards protecting the rights of the inventor and his/her commercial interests, rather than aimed at the benefit of society and providing innovations for the public.

2.1 ORIGINS OF PATENT LAW

The origins of patent law are based on the philosophy of encouraging disclosure of new technology and investment in new technology. The term patent was used in the fourteenth century and is derived from the Latin pater, which means to lay open (i.e., make available for public inspection). A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something or offers a new technical solution to a problem. The issue of public policy has always been whether the exclusive rights given by a patent are justified by the social cost of the temporary monopoly to society. In the case of early patents, the patent was not the reward, but the alternative to the inventor being forced to keep his invention a secret. The patent was an exercise in balancing the interests of the inventor and the interests of the public. If the inventor were going to disclose the full details of his invention so that others could use it after the expiry of a limited term of exclusive rights, then society, in general, would benefit from the new knowledge and technology (Benny, 2020). This is a simplified economic model of how a patent works, but it has not always been the case in all countries throughout the history of patents.

2.2 EVOLUTION OF PATENT LAW

The modern patent system can be traced back to late 15th century Italy where inventors were granted unique rights to their inventions in exchange for public disclosure of the invention and the possibility for further improvement of the invention. This scheme soon caught on throughout Europe (in various forms) and resulted in England passing their "Statute of Monopolies" in 1624 which is commonly cited as the basis for the Anglo-American patent systems that have followed. Throughout these times, the overwhelming philosophy of the patent system was one of utilitarianism with the ultimate goal of encouraging progress in industry and the useful arts. This mechanism of promoting

innovation through exclusive rights has endured; however, the systems used to determine the terms and scope of patent rights have changed drastically (Comino et al.2020).

The discussion above is a pointer that the currently prevalent patent law system has evolved, moving from a simple "reward an inventor" scheme to the complex legal juggernaut that presently does more to hinder than advance scientific progress. While the early system was not without its defects, there are lessons to be learned from history. Basic areas where the modern system fails to serve the purpose of promoting innovation can be appreciated by examining the historical context in which these methods were developed.

2.3 EARLY RECOGNITION OF SUSTAINABLE DEVELOPMENT

Earliest records on legal privileges date back to the Babylonian laws of 2000-4000 BC. Included are several laws that provide for the compensation of a developer. The first recognizable patent system is widely accepted to have been established in Venice, Italy in 1474. The system then spread to England and was fully established with the British Statute of Monopolies in 1624. Widely regarded as the birth of modern patent law, the statute was implemented to restrict the power of the state and to eliminate other patents being handed out without the full knowledge of the patent's details or the patentee's consent. In America, the Commerce Clause and Patent and Copyright Clause of the Constitution gave specific legislative powers to Congress to create a system that would 'promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries'. This meant that the rights that had been given to patents under state statutes in the USA were now under Federal jurisdiction. Early development of modern patent systems also took place in other European countries. Due to colonial links with England, it was common for countries to adopt British systems sometime during the 18th or 19th centuries. Today, patent systems exist almost worldwide (Hathaway, 2021). The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) obliges all members of the World Trade Organisation to provide patent protection for 'any new product or process' in 'all fields of technology'. However, the agreement allows for least-developed

countries to have extended periods, in which they must switch to product patents for pharmaceuticals, and patent protection does not need to be provided for areas where 'it could hamper their capacity to deal with public health problems'.

III. PATENT LAW AND INNOVATION

A patent is a set of exclusive rights given by a sovereign state to an inventor for a certain period in return for his/her disclosing the invention to the public. Since the time it came into existence, there has been continuous debate over the effectiveness of providing patent rights to inventors. There is a view that patents create a monopoly in the market for the patented good and restrict its production and usage. Though initially, it appears to be a case, when analyzed in depth, it gives a different view. This can be explained by recent research in the pharmaceutical industry. Pharmaceutical companies reinvest a substantial portion of their earnings into research and development. Now this reinvestment would not be possible if the company is not able to earn profits from its discoveries. The only way to ensure this and prevent imitation of the drug is by providing patent rights. So patent law has an important role to play in the promotion of innovation and inventions by the companies (Cai & Xu, 2022). Closely related to innovation is technological advancement. The underlying assumption for the promotion of patent rights is that it would result in increased research and development and, in turn, benefit society at large. So there should be a direct linkage between patent rights and technological advancement. These have been measured in terms of a comparison of the rate of technological progress in a field with and without the presence of patents and by examination of the level of research and development in industries that are patent-intensive with those that are not.

3.1 ROLE OF PATENT LAW IN PROMOTING INNOVATION

However, while it is generally agreed that patent protection provides some level of incentive, it is also recognized that it is at best an imperfect instrument. The kind of financial incentive required to induce an individual to innovate varies greatly between different industries and different types of inventions and is dependent on the expected costs of research and development and the expected returns from successful innovation. The patent system operates on a one-size-

fits-all basis through the provision of an invention requirement and a uniform term of twenty years of protection. This can be seen as both under-inclusive and over-inclusive in that for some inventions, patent protection provides too much of an incentive while for others it is not enough. Duration also may be a critical factor in that rapidly changing industries such as information technology may be subject to shorter-term patent protection and not consider patents as a viable means to appropriate returns.

The patent system is predicated on the notion that a package of exclusive rights granted by the state to an inventor will create a financial incentive for individuals to engage in innovative activity that they would not otherwise undertake. This belief is grounded in the view that but for the prospect of gaining monopoly profits, innovators and imitators would tend to the "free-rider" problem resulting in underinvestment in innovation. Incremental innovation would, in many cases, be lost without patent protection as there would be no effective means to appropriate returns. Patents, therefore, are intended to correct a market failure in that they provide an incentive to innovate by internalizing the social benefits of an activity (Blind et al.2022).

3.2 RELATIONSHIP BETWEEN PATENT LAW AND TECHNOLOGICAL ADVANCEMENTS

If the inventor is unable to appropriate the full social value of the invention, they will likely underinvest in R&D, given the marginal private return. This means they will stop short of the point where the marginal cost of R&D equals the marginal social benefit, and the resources used by society to produce new technology will be less than optimal. The theory of static welfare loss explains that a patent is a static monopoly given to the innovator to protect them from competition for a limited period. Stopping imitators enables the patentee to make a supernormal profit by charging a supra-competitive price for their invention. This cost is borne by the consumer, who misses out on only the imitation cost and the departmental incentive to produce a similar product (Shaikh and O'Connor2020).

The section tries to evaluate the relationship between patenting an invention and the rate of technological advancement. To start with, patents provide incentives for R&D and promote faster technological progress than would occur without patents. It has been contended that without patent protection, inventors

and their investors would not be able to recoup their costs, and investment in R&D would decline. This is based on the supposition that knowledge about the invention would be imitable and that without patent protection, a competitor could reverse engineer the invention and produce a copy at a lower cost.

This section of the paper starts with the general provision laid out in Article 27.1 of TRIPS, which mandates that patents should be made available in all fields of technology. It goes on to explain the wide scope of patent protection and the requirement of disclosure, which is the unique feature of the patent system compared to other IPRs. It also discusses how this is beneficial not only for technological advancements but also for the dissemination of technology.

3.3 IMPACT OF PATENT LAW ON RESEARCH AND DEVELOPMENT

Patents provide an exclusive right to their owners, enabling them to develop and market their innovation, while avoiding direct competition during the duration of the patent. It acts as an incentive for research and development since companies can capitalize on their inventions. As activities involving technology become an increasingly large sector of the economy, the advantages of holding a large number of patents have become substantial. This is evident as companies that traditionally did not own patents, such as airlines and service companies, are now becoming major patent holders. It is widely considered that patents promote technological progress. In 1958, a report to the United States Congress found that of the 1137 patents studied, 93% appeared to be technological improvements. However, the extent to which patents achieve this is unclear, and it is especially questionable in the pharmaceutical sector. Patents result in two types of competition. Firstly, there is an 'invent-around' competition in which research and development competitors try to find a way to replicate a patented device. This type of competition is undesirable for the patent owner as it shifts resources away from invention and into research and development (Wu et al.2020). The second type is 'me too' competition in which competitors attempt to produce very similar products. An example of this is the large number of medicines that exist to treat headaches. Usually, this second type of competition is between patented and generic products. Patents create a monopoly which is great for

the patent owner in terms of profit. However, this loss of competition is detrimental to consumers and has led to calls for a link between research and development and patents to be broken (Benslimane et al.2023).

IV. ACCESS TO MEDICINES

The pharmaceutical industry is one area where the patent law has been used effectively to promote R&D and protect the interests of the inventor. This is a situation where society is faced with a higher standard of living and quality of life at the cost of affordable medicines. Under the TRIPS Agreement, developing countries were given a transition period of 10 years to comply with the patent protection of pharmaceuticals. The least developed countries have until 2016 to implement any patent protection. The Agreement also provides compulsory licensing of such pharmaceuticals in situations of national emergency or other circumstances of extreme urgency or cases of public non-commercial use. Compulsory licensing, remuneration provided to the right holder, and limitations as to its duration and termination, are some of the flexibilities built into the Agreement which still protect the interest of the patent owner. This is a complex issue with no simple solution. People agree that if there were no patent protection for pharmaceuticals, there wouldn't be such extensive R&D into new medicines. The patent is still needed to provide an incentive to research and develop new drugs. High drug prices have led people to scrutinize whether patents are doing their job, by weighing the costs and benefits. Generally, the costs are increased much more than the benefits provided. This is a problem that is a result of patents working too well. High drug prices are also due to global market segmentation, where many developing countries do not have to grant patent protection to medicines until 2005. This has led to price discrimination, where drug companies charge higher prices in markets where they have a patent. The recent issue of patents and access to medicines depicted the Doha Declaration which released a WTO statement on the 14th of November 2001. This was a reaction to the increasing global concern about the impact of TRIPS on public health, in particular the situation in many developing and least-developed countries. With increased cases of HIV/AIDS, malaria, and tuberculosis, these countries need to access

affordable medicines to treat widespread diseases. A main decision of the Doha Declaration was to find a solution where the TRIPS Agreement would not prevent member states from taking measures to protect public health (Urias & Ramani, 2020).

4.1 PATENT LAW AND PHARMACEUTICAL INDUSTRY

Patent agreement is one of the most important regulations of the World Trade Organisation and is designed to encourage research and development for health needs. Companies are awarded patents for 20 years which is intended to give them time to recoup the costs of research and development of new chemical entities through the sales of the patented medicine. In the pharmaceutical industry, the argument is that patents are the only way to recoup massive investment in research and development, as the freedom for generic manufacturers to produce a patented product will cause the originator company to lose the returns on their investment, as the price of the generic will always be lower. This system is intended to provide a balance between the costs of future research and the consumer's need for access to affordable medicines. Patents are a form of market intervention, and the pharmaceutical industry argues that without effective patent protection, consumers will suffer in the long run from a lack of essential new drugs. According to an industry report, in the past three decades, over 1500 new drugs have been developed, of which one-third were compounds to treat cancer or infectious diseases. The argument from the industry is that patent protection provides the incentive to develop such drugs because in many cases they would not be commercially viable. It is believed that without effective patent protection, there will be a shift in research and development investment from new drugs to new versions of existing drugs. This is because the lack of market exclusivity allows other companies to produce the same product and as patented products and new products are medically identical, consumers and doctors will in most cases, choose the cheaper generic product (Morin et al.2023). Due to these trends, it is thought that the new chemical entities of the future will not be in the best interests of the consumer.

4.2 BALANCING PATENT PROTECTION AND ACCESS TO AFFORDABLE MEDICINES

Since 2001, the World Trade Organisation (WTO) and World Health Organisation (WHO) have begun to work on the relationship between the agreement on Trade-

Related Aspects of Intellectual Property Rights (TRIPS) and public health. This was due to increasing pressure and controversy over access to affordable medicines in developing countries. The Doha Declaration in 2001 was seen as a turning point in this debate. It confirmed that TRIPS does not and should not prevent member states from taking measures to protect public health. The most controversial and significant section of the declaration was regarding compulsory licensing and parallel importing. Members agreed that the TRIPS agreement can and should be interpreted to support members' rights to protect public health and, in particular, promote access to medicines for all. Both parallel importing and compulsory licensing are mechanisms to make patented medicines more affordable. Parallel importing involves importing a patented medicine from another country where the same medicine is sold at a lower price (Osode, 2022). This is a commercially oriented mechanism and secondary patents and exclusivities on certain medicines can hinder its effectiveness. This means that parallel importing should have little effect on patent holders' original rights, and grace periods for patents can further hinder access to newer drugs.

4.3 CASE STUDIES ON ACCESS TO MEDICINES IN DEVELOPING COUNTRIES

A study from the US-based Massachusetts Institute of Technology simulated the effects of stronger patent protection on 17 major drugs. The study projected that the economic costs to India would be up to \$3.8 billion per year. Up to 96% of this loss would come from increased spending on drugs due to the absence of generic versions. The increased costs of drugs affected by patents would be \$1.5 billion. This is a substantial sum considering that in 1997/98, the per capita public expenditure on healthcare was below \$5. The study claimed that the impact on public health would be substantial and that there would be a sizeable increase in the number of people suffering from diseases because they would no longer be able to afford the drugs (Bang et al.2022).

This case study looks at the effects of introducing product patent laws in India. Non-governmental organizations have raised concerns that a stronger patent law will reduce the number of drugs available to treat diseases such as tuberculosis, malaria, and HIV. These diseases are widespread in India and also affect the poorer people in society for whom cheap drugs are

essential. TRIPS does provide some safeguards to protect public health (Urias & Ramani, 2020). A compulsory license can be sought to manufacture a generic version of a drug at a lower price. Under certain conditions, drugs can also be imported. However, critics argue that these measures will be too difficult to implement and that the number of drugs affected by patent laws will still be substantial. There is also concern that research and development in the domestic industry will be reduced. (Shadlen et al.2020)

India does not have any product patent laws on medicines, which means that generic manufacturers can copy any drug not under patent and do not have to spend money on research and development (Plahe & McArthur, 2021). This has led to the development of a large pharmaceutical industry. The availability of cheap generic drugs has also led to India becoming known as the "pharmacy of the third world". India has been under pressure to change its patent laws since it joined the World Trade Organisation. To comply with the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement, India had to introduce product patent laws by 2005 (Mani, 2021).

V. TECHNOLOGY TRANSFER

Technology transfer, the process of sharing and disseminating knowledge and technologies among different countries and companies, is widely recognized as an important means of promoting sustainable development. This is because it enables countries to find solutions to their problems, learn from each other's successes and failures, and leapfrog technologies - thus saving time, effort, and resources. There are many mechanisms for technology transfer, ranging from the very familiar - imitation, licensing, and joint ventures - to the more complex and indirect learning by doing processes. Firms also engage in R&D collaborations and research contracts, where the lines between who is learning from whom can be blurred. An important distinction is drawn between vertical and horizontal transfer. The former refers to transfer taking place between entities at differing stages of technological development, and the latter indicates transfer between similar entities. Vertical transfer is what takes place between multinational enterprises and their developing country subsidiaries, and it is often the case that the latter are being tasked with simply imitating existing technologies, products, and processes (Fu et al., 2021).

5.1 ROLE OF PATENT LAW IN TECHNOLOGY TRANSFER

The role of patent law in technology transfer is a complex one. As mentioned earlier, the establishment of property rights in the form of patents is likely to provide a greater incentive for research and development by increasing the potential returns from new inventions. This suggests that patent rights may enhance the rate and direction of inventive activity, which contributes to the increased flow of new knowledge. As knowledge is a public good, any increase in its production is a positive thing. However, the use of patents as an incentive for knowledge production may have disadvantages. Patents are a temporary monopoly right and may limit the use and further development of an invention due to the high costs of negotiating rights to use a patented technology or the fear of unintentional infringement. This can be particularly problematic for developing countries who wish to 'catch up' by using technology developed in countries with higher technological capabilities. Consequently, restrictions on the use and imitation of patented technology can impede cumulative learning processes and slow the rate of technological catch-up. This is of particular relevance to sustainable development which relies on using technology to solve various environmental and social problems. Emission-reducing technology is often developed in developed countries but is urgently needed in developing countries to avoid the lock-in of polluting technologies. A slow rate of transfer of clean technologies can have negative implications on the global environment (Vershinin2021).

5.2 CHALLENGES IN TECHNOLOGY TRANSFER FOR SUSTAINABLE DEVELOPMENT

The difficulties in moving technology developed in one place in the world to another location are generally highlighted in the literature as being the problems faced by developing countries in their efforts to employ technological solutions to their persistent problems in the social, economic, and environmental sectors. There are two main ways most developing countries access patented technology, and that is through imitation/invention and creation. This is mainly in sectors such as agriculture and pharmaceuticals. A vast amount of technology in these areas is owned by multinational enterprises (MNEs) from the developed world. These companies are often the holders of many patents in their technology and seek to avoid imitation and instead create joint ventures and licensing

agreements with partners in other countries (Taubman, 2009). The main difficulty facing developing countries here is the high cost of entering into such agreements. In the current global economic state, many MNEs have reduced their research and development spending which has led to less international technology transfer taking place (Maskus, 2004). This has been seen with the global reduction in patent applications in the recent economic climate (GIPA, 2009). This has been worsened by the reluctance of some MNEs to deal with countries where there are concerns about the security of their intellectual property rights (Maskus, 2004). This was the case with the African Group which went before the Doha Ministerial Conference and requested an extension of the waiver allowing them to import cheaper imitation drugs. They claimed the reason was that they had insufficient capacity to produce the drugs themselves and lacked technology and knowledge in this area. It was said often the MNEs were not willing to offload their best technological know-how to these countries due to fear of pirating and imitation (Anon, 2001). This makes it quite difficult for these countries to obtain the best possible technology available (Van Der Waal et al., 2021).

5.3 STRATEGIES TO ENHANCE TECHNOLOGY TRANSFER

Third, the idea of extending multilateral funding for technology transfer has been raised. This could be a technology-specific part of the GEF or the creation of an international fund of the sort described in the above paragraph. This is generally considered one of the most effective means of technology transfer in areas of social importance, and the revenues of various funds could be used to develop national capability in managing environmentally sound technologies. It is also worth noting that the more widespread the development of a given technology, the less likely it is that IPRs will be a barrier to its transfer, and this, in turn, reduces the likelihood of IPRs becoming a trade barrier.

Second, it has been proposed that more flexible intellectual property standards might be set for environmental technologies or LDCs. For example, environmental and development NGOs suggested the establishment of a list of technologies that are of social importance for sustainable development or specific environmental value. These could be accorded a special status such as public domain or commons. This proposal is interesting but problematic, especially in the case of patents. As discussed above, there may be difficulties in

overriding national treatment, and once patents have been issued, it may be difficult to enforce a differentiation in their treatment. An alternative and perhaps more feasible proposal is a system to subsidize the patenting of environmental technologies or to underwrite purchases of environmental patent licenses. The latter could be done by an international fund, created from levies on polluting industries or ODA appropriations with a commitment to an annual commitment to its duration and funding level. Any such subsidization or underwriting would support price and non-price transfer of environmental technology.

First, it is essential to enhance the capacity of developing countries to manage technologies, which includes creating or enhancing national systems of innovation and technology management. This would involve technical assistance programs to developing countries, and negotiating an increase in financial and human resources for technology development, adaptation, and innovation. Something which would be in their long-term interests and could potentially be financed with the foreign exchange saved from reductions in debt or increases in aid disbursements. It is widely recognized that technology management is a weak capacity in many developing countries and it underlies their inability to absorb or innovate with foreign technologies.

Several strategies have been suggested by various groups, including developing countries, non-governmental organizations, academics, and international agencies, to facilitate increased technology flows and the acquisition of cleaner and more efficient technologies by developing countries. These are by no means mutually exclusive strategies, and some of them might be pursued separately or simultaneously in various sectors.

VI. ENVIRONMENTAL PROTECTION

The integration of appropriate environmental considerations is a major theme of sustainable development. However, in terms of the extent to which environmental concerns are internalized in a given society, it would be difficult to credit a society with having achieved sustainable development since the needs of future generations are not being met. Despite various international accords and national measures, the rate of environmental degradation remains a serious concern. A range of policy tools are used in an attempt

to reconcile the innovation and diffusion of cleaner technologies on the one hand with the need to prevent the imitation of such technologies by free-riders on the other. The use of trade secrets as a form of intellectual property to prevent rivals from accessing proprietary technology is one such method, which while effective for the individual firm has the overall effect of slowing the rate of technological progress and preventing the widespread diffusion of such technologies. An alternative approach to preventing the imitation of new technologies is the use of various forms of government regulation and direct investment in clean-up and abatement activities (Ali et al., 2021). Patents have both positive and negative effects on these activities and can therefore be a more or less useful tool depending on the nature of the technology in question and the regulatory context in which it is to be applied. In assessing the overall effect of patents on environmental protection it is important to acknowledge that they are a double-edged sword; while patents may encourage innovation in cleaner and more resource-efficient technologies, the granting of exclusive rights may also impede the subsequent diffusion and development of these technologies.

6.1 PATENT LAW AND ENVIRONMENTAL INNOVATION

Putting aside the issues of misuse of the patent system and the need for technology transfer discussed in earlier sections, there are several basic ways in which the existence of patent rights may impact the rate and direction of environmental innovation. The most obvious of these is through providing inducements to undertake new R&D which is targeted at developing clean technologies. The discounted present value of the stream of prospective profits from a successful new technology is its expected future revenue streams, less the costs of developing the technology, scaling it up to commercial-level production, and marketing it to the point where a sufficient market share is captured from it to cover these costs and provide the innovating firm with a competitive rate of return. The longer the expected duration of the revenue stream, the greater will be the net present value of pursuing the technology in question, conditional upon the future revenue streams being non-random and the costs being avoidable. Since the term of the patent effectively provides a time-limited monopoly right to exploit the patented technology which would be infringed by the unauthorized copying of that technology, all the profits accruing from the patented technology should on

average be received by the innovating firm over and above the otherwise incurred development, production, and marketing costs if the patent is granted. This in turn means that the longer the expected duration of the patent, the greater the expected net revenue from successful invention and hence the greater the expected rate of return to R&D. Bear in mind, however, that global welfare might not be improved by longer patents if this means that a net higher rate of resources are allocated into R&D because of the presumed high elasticity of demand for medical patents. Longer patent terms in the US provided for certain medicines as a consequence of the Uruguay round agreement on Trade-Related Aspects of Intellectual Property Rights have been the subject of harsh FDA critiques. This suggests that legislation on patent terms will usually have to be carefully considered (Töbelmann & Wendler, 2020).

6.2 ENCOURAGING GREEN TECHNOLOGIES THROUGH PATENT PROTECTION

Patenting may be a double-edged sword for the environment. On the one hand, patenting makes the information contained within the patent public, allowing for knowledge spillovers and follow-on innovation. This is good for environmental protection as it stimulates further innovation in environmentally friendly technology. On the other hand, environmental technology is often complex requiring significant research and development. Companies may be reluctant to invent and innovate new environmentally friendly technology if they cannot appropriate some returns. This is especially pertinent for a Saddles and Evans-type technology that is a long-term solution to an environmental problem. If the technology is a sunk cost, patenting it may not be beneficial. Reward for innovation can come from many different sources such as first-to-market advantages, cost savings from increased efficiency, and positive public relations. It may be that the firm judges that these alternative mechanisms for appropriating the returns to innovation are not as cost-effective as patenting an invention, in which case they will choose not to innovate. An example is the development of fuel-efficient automobile engines for which there is much environmentally friendly demand (Kalwar and Agarwal2020). However, there has been very little green innovation in the automobile industry compared to the invention and innovation of the catalytic converter for which there were very clear patents and a large revenue. This may

be due to the complexity of new engine technology and the reluctance of alternative engine developers to innovate knowing that they cannot sell the engine as there is no fuel-efficient engine to meet new environmental regulations. This engine developer may decide that it is not worth innovating compared to developing a cheap knock-off version of an existing engine and devote its research and development toward that end.

6.3 CASE STUDIES ON PATENT LAW AND ENVIRONMENTAL PROTECTION

Case Study 1 – The Montreal Protocol
The Montreal Protocol is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion. In effect, the protocol has forced innovators to develop new technologies to replace the old. The most effective way to stimulate a rapid increase in environmentally friendly alternatives is to protect the new technologies. Patents provide a period of market exclusivity that allows the patent holder to charge higher prices than would be possible under competitive conditions (Mummery, 2021). This will generally accelerate the rate of return on the new technology and increase the total amount spent on research and development. The result is a larger number of higher quality patents in a given technology and a quicker transfer of the new technology into widespread use. Nevertheless, some of the new technologies are controversial, for example, incineration of harmful gases versus catalytic conversion to less harmful forms. In this case, patenting could hinder the diffusion of technology to developing countries where the protocol requires the phase to be expedited, whilst maximizing the global environmental benefit. Patents create a monopoly and the higher prices for patented technologies could preclude the use of the technology in some countries. Although the overall effect on the environment could be as positive as the protocol intended, there may be some areas where the patented technology is the worst environmental option. (Zhang and Balakrishnan2022)

VII. INTELLECTUAL PROPERTY RIGHTS AND INDIGENOUS KNOWLEDGE

A study of patent law's interaction with indigenous communities in the context of a disease and its cure is instructive. In their research of the San for the

development of a cure for tuberculosis using wild garlic, Kerr et al. explain how the strict adherence to general patentability criteria conferring rights to the state or corporation can result in the disempowerment of the knowledge-holding community. Step one in the patent application process is public disclosure of the invention, and it is a well-known fact that the vast majority of cures patented in the pharmaceutical industry are derived from natural substances and folk medicine. At this point, the knowledge has the potential to be defined as 'prior art' after which the community in question has lost rights to the invention and the patent can be issued to an external agent. The San are then placed in a situation where enforcement of their rights through revocation of the patent is both difficult and costly (Burch et al., 2023). There must be provisions within the patent system that will prevent rights disputes of this kind from arising and ensure that marginalized communities can control the use of their knowledge and negotiate terms for technology transfer. However, considering the extant status of traditional knowledge as 'public domain' and its vast undocumented nature, it may be unfeasible to provide patent rights on all inventions and thus alternative forms of protection must be sought.

In general, local communities ought to acquire substantial benefits from the use of biodiverse resources and related knowledge. However, more often than not, it is the state and the corporation who hold the rights and therefore gain the revenue from developing nations' biological and genetic resources. The TRIPS agreement goes some way to addressing this imbalance. For example, when it states in Article 8.2 that members may exclude plants and animals from patentability, and in the setting of more specific codes for the protection of traditional knowledge and folklore, it has been recognized that these forms of knowledge are important to preserve and add to the store of human culture. This knowledge can also hold the key to vital data about sustenance and health for many indigenous and local communities and serves as a vital underpinning for further innovation. However, western-based IP systems may not provide adequate protection of this knowledge and in some cases may result in usurpation and exploitation of resources without the consent of or adequate recompense to the knowledge holders (Srivastava & Rana, 2020).

7.1 IMPACT OF PATENT LAW ON INDIGENOUS COMMUNITIES

This section will cover the impact of patent law on indigenous communities about their traditional knowledge. The issue of traditional knowledge protection is relevant to indigenous communities in developed countries like Australia and New Zealand, and indigenous communities in developing countries such as India and the Pacific nations. The TRIPS agreement and the CBD, although conflicting, are both centered on protecting the rights of those who invent or create new things. The issue with the TRIPS agreement is that it establishes a set of minimum standards for the protection of intellectual property rights. The agreement is very much biased towards providing strong protection for commercial interests. This contrasts with Article 8(j) of the CBD which says: "Subject to its national legislation, respect, preserve and maintain knowledge, innovations, and practices of indigenous and local communities embodying traditional lifestyle relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, with the involvement and approval of the holders of such knowledge, innovations, and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge innovations and practices." (Richards, 2020)

7.2 PROTECTION OF TRADITIONAL KNOWLEDGE AND CULTURAL EXPRESSIONS

Ancestral knowledge of indigenous communities has been an undervalued and exploited resource and traditional customs have been subject to intellectual property rights infringement. Although tailored provisions have been introduced in certain cases such as the sui generis systems under the TRIPS agreement, it is difficult to enforce these provisions, and hurdles in evidencing prior art and invention often make it difficult for indigenous communities to prevent misappropriation of their intellectual property. This issue concerning patent law and rights to traditional knowledge was subjected to a WIPO intergovernmental committee, however, the presence of adverse effects of existing multilateral agreements has thus far impeded the development of an international legal instrument that can effectively protect the interests of indigenous and local communities (Fredriksson, 2021). This is a

fundamental issue as it is an obstacle to the fulfillment of global justice and sustainable development which favors the use of diverse forms of knowledge to address the complexities of social, economic, and environmental problems.

Our work has postulated that the public international law system, particularly trade and investment law which incorporate international intellectual property law, continues to perpetuate a process of economic globalization that is not conducive to sustainable development. About the impact on indigenous communities, it has been seen that the IPR regime that was established and evolved has led to the misappropriation and exploitation of indigenous intellectual and cultural property.

7.3 BALANCING INTELLECTUAL PROPERTY RIGHTS AND CULTURAL HERITAGE

However, Art 8j states that members are free to determine whether a particular subject matter is to be considered traditional knowledge and that IP protection may/will be inappropriate. The agreement recognizes the importance of traditional knowledge without providing specific measures to protect it. This reflects the current status of international agreements and a lack of international consensus on the level of protection offered to indigenous communities.

The IP system aims to create an international IP system that will promote balanced and effective protection of IP rights, deriving upon traditional knowledge, and will facilitate the transfer of technology and the dissemination of creative and innovative works in such a way as to contribute to sustainable development, to indigenous people's cultural heritage and the well-being of all nations. This is a challenging goal due to the differing needs from country to country and the differing IP provisions. The Agreement on Trade-Related Aspects of International Property Rights (TRIPS) does not provide substantive provisions to protect traditional knowledge or expressions of folklore.

VIII. INTERNATIONAL AGREEMENTS AND HARMONIZATION

There are currently several international agreements that address the issue of patent laws. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which is part of the WTO agreement, is the most far-reaching of these. It has a large number of

provisions that set out minimum standards for the protection of IP and several enforcement measures. The agreement effectively binds a large proportion of the world's countries to a single set of IP laws. It has been the subject of a large amount of debate and controversy, particularly in its implications for access to essential medicines and the transfer of technology to developing countries. Other agreements include the Paris Convention, the Patent Cooperation Treaty, the European Patent Convention, and the Andean Pact. There are also several agreements between individual countries regarding the recognition of patents granted in each other's legal systems.

The basic philosophy of international agreements is that it should be possible to obtain patent protection of at least an equivalent strength in all signatory countries. This is based on the belief that adequate protection of IP is important to encourage research and development everywhere. This philosophy is, of course, not necessarily consistent with the principle of common but differentiated responsibilities for the environment as indicated in the Rio Declaration. Developing countries have often been pressured into adopting strong protection of IP, and it is not clear that this is always in their best interests. TRIPs mark a significant strengthening of the multilateral agreement on IP. Global harmonization of patent laws involves more than mere formal compliance with the various international agreements and treaties. A general understanding of the basic approach to patenting is essential. Developing that mutual understanding involves a learning process for countries confronted with a technology new to them and can become a show-and-tell process by innovative companies from developed countries. In the past, it has been relatively easy to change the formal law to facilitate or impede the grant of a patent. This is no longer true because of the complexities and subtleties that affect patent rights flowing from international trade issues. The laws of several countries have been subjected to comparison and contrast and have developed in a highly interconnected way. The ability of a company to obtain a desired result in one country and then rely upon it in dealing with another country is an important aspect of global patent rights. A company may be of the view that its best strategy is to seek changes in the law of country A that will provide better leverage for it vis-à-vis country B. This is typical of the global orientation that a significant part of patent law has taken. Steps have at times been taken to

intentionally alter substantive patent law as a means of trade policy, but that goes beyond the scope of this writing.

8.1 OVERVIEW OF INTERNATIONAL AGREEMENTS RELATED TO PATENT LAW

This agreement between two of the world's largest patent offices is a recent development but has significant effects due to the large number of applications and the economic value of the resulting patented products to the international community. Collaboration and exchange of information aim to improve the quality and efficiency of the examination process by reducing duplication of work and conflicting decisions and improving the quality and utilization of resulting patent rights. With increased globalization and the increasing importance of patents in international trade, there are increasing demands for further cooperation with other patent offices.

A3- Cooperation between the European Patent Office and the US Patent and Trademark Office

This treaty was aimed at simplifying and harmonizing the formal procedures of national and regional patent applications and patents. It allows for the standardization of formal requirements for patent applications and the creation of a more user-friendly and less burdensome system for patent applicants. The treaty provides an agreement on various important aspects of the patent procedure. This includes application through the minimum requirements that a country can ask of an applicant, the definition of a filing date, form and content of the application, the priority right, representation, recordation, formality examination, publication, and licensing. Through the simplification of these processes, additional agreement is required for substantive harmonization of the resulting patent rights.

A2- Patent Law Treaty:

This was a project aimed at assessing the advantages and disadvantages of various methods for elaborating or improving technical and legal integration of patent systems through the harmonization or coordination of the resulting rights and obligations. The project made various reports and findings to ascertain the best methods for achieving the integration of patent systems and explored the consequences of more integrated systems for the international community. Although the project has not led to any actual changes in international agreements or policies, it is significant in

helping to better understand what is required for more harmonized patent laws and to provide a foundation for future development preventing patent law distortions in the international trade of resulting patented products.

A1- Methodologies for Technical and Legal Integration of Patent Systems:

This agreement was made during the Uruguay Round negotiation in 1994. One of the main reasons why TRIPS is significant to patent laws is for the first time in history it provided a comprehensive and detailed set of rules concerning IP from member countries in a single agreement. This was a significant step from previous GATT agreements which had very little attention on IP laws. The agreement spans patents, copyrights, trademarks, industrial designs, geographical indications, and enforcement of IP laws. Regarding patents, the main areas of concern are the terms of patent protection, the types of inventions that can be patented, patent enforcement, and finally the transfer of technology. TRIPS sets out minimum standards of protection which all member countries must abide by, and failure to do so can result in trade sanctions or remedies in the related trade sector. Consequently, the agreement is often criticized for its potential negative effects on developing countries. However, TRIPS has been important in that it has since encouraged developed countries to provide technical and financial assistance to help promote sustainable development and to aid the understanding and implementation of the new rules in various areas of IP law.

8.2 CHALLENGES IN HARMONIZING PATENT LAWS GLOBALLY

The burgeoning use of the International Trademarks Law Treaty even within the European Union has led to encroachment on EU competence in trademark lawmaking. On the other hand, the global agreement format may allow developed countries with an interest in avoiding increased IP protection costs at home to move towards less protection in multilateral treaties, thus forcing developing countries to move in the opposite direction to reach an agreement, with the potential result of greater global disparities in the innovative activity and terms of access to knowledge. The Treaty establishing the European Patent Office has far wider membership than the EU, is successful in terms of efficiency, and has achieved a great degree of harmonization. An additional part of "Fragmentation by

international agreement" could be a useful and informative case study of successful global harmonization (Kur2023). Finally, how international patent agreements displace or override national legislation, potentially bringing disparate and uneven results, are often somewhat opaque and without clear lines of democratic accountability.

8.3 BENEFITS OF INTERNATIONAL COOPERATION FOR SUSTAINABLE DEVELOPMENT

Data protection and reverse engineering have led to increasing litigation before the international court, and with the trend of global innovation being a sensitive location, patent conflicts are sure to occur. This is why patent holders are considering the entrance of the session and proceeding. One of the most practical ways to avoid conflicts is to allow foreigners to patent their inventions in the home country and stipulate both sides have non-reciprocal licenses. This way, each side needs to prove infringement to gain effective suspension. Coercion and haste can have adverse effects, so pushing towards a method where international enforcement will be made is important.

In these situations, it may be best for the inventor to request that the invention not be made known, subject to the knowledge that a leap of success will take a less sophisticated local inventor. In this case, the patentee can defer the patenting process to some extent without fear of losing their competitive edge. However there is a risk that the copier will produce the same solution independently, and if the invention has wide application, it could prevent a switch to clean act time infringement is threatened. Full communication of the invention and the existence of alternative detrimental copying can be avoided if the copier is prohibited by injunction. Enforcement of foreign patents is the only way to prevent infringement copying of the above sorts (Gmeiner & Gmeiner, 2021). A comparison between the revenue derived from a patented product and the costs of enforcing a foreign patent, as opposed to the costs and likely result of an action on infringement locally, can simplify the decision. The revenue derived from the patented product should be forfeited if the costs of enforcement of a foreign patent are too similar.

Infringement copying occurs in the hope that it will not be detected, or if it is, action will ensue and the copier will argue that what he has done is not covered by the patented claim. If the copier is successful, the patentee will avoid detection of further infringement to prevent

frustrating expenses on an uncertain action to construe the scope of the claim (Hillman and Baydoun2020). Infringement copying also takes the form of copying the substance of the invention but making a minor design change beyond the range of design patents, to avoid more expenses since the costs of adopting an infringement claim are excessive. Successful copying leads to avoiding wastage of expenditure and theft of intellectual property, along with a loss of market share for the patented product.

When the domestic patent system is weak or ineffective, foreign firms are deterred from associating with local inventors. This is especially true when the inventor's creation is not in the same technological field as the firm and when the relevant market is small. In these circumstances, the risk of infringement liability and the fear that a local competitor will be able to legally copy the product stifle technology transfer (Damioli & Marin, 2024). This is because the patentee, who lets the invention be known as protected knowledge, is afraid of episodic copying that may occur before the invention has been fully communicated. However, in situations where communication is not completely successful, the likelihood of a successful defense of a process or method patent, for instance, by relying on the fact that what is being done by the copier is still within the scope of the claim, becomes less certain.

International cooperation related to patents can facilitate the shift of technology to developing countries. This can be achieved through several ways, like compulsory licensing and easier access to essential patented drugs. However, the most effective way is if the owners of technology are encouraged to share their know-how. This can be done through a variety of collaborative arrangements, joint ventures, sub-contracting, and licensing, which are designed to promote local capacity building.

IX. POLICY RECOMMENDATIONS

Intellectual property incentives must strike a balance between the competing needs of owners and users of technology. The theory suggests that strengthening IP protection should stimulate domestic innovation and attract foreign technology, thereby promoting economic growth. However, the effects of stronger protection are uncertain, both in theory and in practice. The part of the Agreement on Trade-Related Aspects of

Intellectual Property Rights (TRIPS) that has attracted the most attention is the requirement that patents be available for twenty years. This represents a substantial strengthening of minimum protection for many developing countries and has been the focus of considerable opposition from the public health community. In response, a variety of mechanisms have been suggested to mitigate the impact of stronger patent protection, including changes to the compulsory licensing system and patent exceptions for essential medicines. The high price of new pharmaceutical products is a problem for healthcare systems in both developed and developing countries, and there has been much debate over how to promote access to essential medicines at affordable prices without undermining the pharmaceutical industry's capacity to innovate.

9.1 IMPROVING ACCESS TO MEDICINES THROUGH PATENT LAW REFORMS

Developed and developing countries differ in the appropriateness of protection for the pharmaceutical industry. Research and development for new drugs is a high-cost and high-risk activity, and pharmaceutical companies argue that strong patent protection is essential in providing the correct incentives. However, the monopoly pricing power that is a result of the patent can often be against the public interest. This is because patents provide exclusive rights to make, use, and sell a product for 20 years (from the filing date), so it is possible to charge a price that is much higher than the marginal cost of production (which is the only price that a competitive market would allow). It might well be that it is not profitable for a company to invest in research that will have a major impact on the health of people in developing countries because although the marginal cost pricing would be higher than third-degree price discrimination, it would still not cover the cost of R&D. In this case, the opportunity cost of the resources used in the research would be to divert the sales revenue into other products that are less costly to develop. One solution to this is to improve the system of compulsory licensing, which is when a government allows a company to produce a patented product without the consent of the patent owner. This is already a provision in TRIPS; however, some LDCs have argued that the conditions are too restrictive. It can be difficult, however, to strike a balance between providing an incentive for research and allowing more generic competition because the latter can significantly reduce

the value of a patent and therefore the incentive for R&D. Another proposition is to provide more public subsidies into research for diseases that mainly affect people in low-income countries. This would reduce the opportunity cost of research as the firm can benefit from profitable R&D and then still get a return closer to $MC=AC$ pricing because the government will constitute the profit on sales.

9.2 PROMOTING TECHNOLOGY TRANSFER FOR SUSTAINABLE DEVELOPMENT

Theoretical models of the effects of patent protection on international technology transfer predict that the influence of suitably tailored patent regimes will vary according to the type of technology involved. Static models of incentives for R&D investment suggest that stronger patent protection will cause technology donors to prefer more proprietary forms of technology transfer. It is widely believed that this will be through sales of patented products or the licensing of patented production processes. The right to exclude imitators will increase the returns from these forms of technology transfer. However, the mechanism may not apply to high-technology industries in developing countries, for the beneficiaries of foreign technology may prefer to incur invention and development costs to imitate the technology, and only then buy a license to avoid being sued for infringement. An example in a developed country industry may be the purchase of a license for a software package to avoid developing in-house software to perform the same function. This income effect is the negative sum game which occurs when an increase in price leads to increased welfare for the seller and decreased welfare for the buyer. If we sum the effect across all purchasers of the technology, recent empirical studies have formalized the conditions under which this game will cause net in-migration of technology investment. This occurs if the utilization of the technology in the importing country is a substitute for the product which it would otherwise have exported, and if the price elasticity of demand for the technology is less than one. However, if the technology developed is a higher substitute for the imported item then the price increase will cause technology donors to switch to development and production of the patented item in the importing country. Given the importance of the price elasticity condition, it signals increased spending by the donors, this is precisely the level of technology investment that we would like to promote in the area of medium to high technology industry. This

is because increased development and production costs will involve skill formation and learning by doing, which are important spillover effects for the acquiring country. Simulation studies of the effects of changes in patent law on the amount and type of technology transfer have confirmed that as compared with a general move towards stronger patent protection, targeting patents in those sectors of industry that are most important for development may lead to reduced proprietary technology transfer, but overall net gains in the amount and type of technology obtained.

Promoting technology transfer for sustainable development. Technology transfer is widely regarded as a means to enhance the capacity of developing countries to acquire and diffuse foreign technology and know-how for the welfare of their citizens. However, the link between international technology transfer and improved patent regimes is not as straightforward as suggested by conventional wisdom. Given this, we attempt to identify how broader changes in international patent law or enforcement may affect the quantity and quality of technology transfer to developing countries, and calibrate our proposals to encourage technology transfer in those areas of technology most important for development.

9.3 ENHANCING THE PROTECTION OF INDIGENOUS KNOWLEDGE AND CULTURAL HERITAGE

Traditional cultural expressions and biological resources are of increasing interest to industries throughout the world. New uses are continually being discovered for genetic resources, and a wide range of products embody or are based on traditional cultural expressions. The growth of the biotechnology industry only increases the significance of biological resources and traditional knowledge. Effective protection of traditional knowledge and cultural expressions, which is an essential condition for the continued preservation and development of indigenous cultures, is not only in the interests of the indigenous peoples who are its holders but also in the interest of the general public who will derive greater benefit from indigenous innovation and culture if such knowledge is not eroded. There is therefore a global interest in the effective protection of traditional knowledge and cultural expressions and the prevention of their misappropriation. To achieve this, there needs to be an appropriate and effective legal and regulatory framework. This is highlighted in the IP and sustainable

development conclusions which call for the integration of traditional knowledge into the modern intellectual property system. However, because of the potential conflict between the diffusion of global knowledge and the protection of local knowledge, and because the modern IP system has developed to suit the interests of developed countries and industries, this will not be an easy task.

At present, there is no effective *sui generis* protection for the full range of expressions of traditional culture. The consequence has been that trade in indigenous artifacts, and products based on indigenous forms of knowledge or cultural expression has expanded greatly. Inadequate protection of folklore and traditional cultural expressions against misuse has seen indigenous peoples dispossessed of their knowledge and cultural heritage, with traditional creations that have passed into the public domain being used and sometimes misused by others without any attribution or benefit to their original creators. This has contributed to the economic and social marginalization of indigenous peoples and has eroded the incentive for the transmission of traditional culture to the younger generation.

X. CONCLUSION

Of specific concern are medications to combat major global pandemics and diseases that predominantly affect the world's poor. With major diseases, LDCs will often issue a compulsory license, a provision that allows the manufacture and distribution of a patented product without consent from the patent owner. Accompanied by Article 31 of TRIPS, this act undermines one of the most important concerns for sustainability in developing countries: the ability to create a domestic technological base. Yet, some argue that under TRIPS, case law in a WTO dispute settlement gives scope for a broad interpretation of the Doha Declaration, and a compulsory license may be issued in the interest of public welfare with minimal remuneration. But it is uncertain how multilateral agreements on patent enforcement, such as the recent Anti-counterfeiting Trade Agreement, will affect this developing area in international law, and if changed circumstances will better serve the poor and the global environment.

Patent protection was not always seen in the context of sustainable development. Yet, a shift in focus from technology protection to human and environmental

prosperity brings to light how patents and the legal frameworks that support market exclusivity can affect the rate and direction of technological change in developing countries. The fact that LDCs are in the process of adopting or re-strengthening patent protection before their full phasing into the TRIPS agreement means that at this juncture, thorough analysis of potential costs and benefits has important implications for decisions made now will affect the position of these countries and the state of global sustainability for many years to come. The adoption of TRIPS by the WTO was not an exclusive agreement of means to promote sustainable development, which allows for some flexibility for enforcement strategies in developing countries. To ensure a suitable balance between technology promotion and prevention of market failures in promoting public health, climate stabilization, and biodiversity conservation, further research in this area is necessary.

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