Study on Intellectual Property Rights and Economical Development

Abstract :

A "strong" IPRs regime, in the sense of providing robust protection of private intellectualproperty rights, was not a necessary prerequisite for their economic growth, according to thehistorical experiences of the now-developed nations while they were growing themselves,which we reviewed. Most of them did not provide PIPRs with any real protection until quitelate in their development related to life science and especially biotechnology. Even the mostdeveloped nations, like the UK and the US, didn't create robust PIPRs regimes until themiddle of the 19th century (with the exception of copyright protection in the US's instance),while the less developed nations didn't establishsuch regimes until much later.For thepurposes of this paper, it is more important to note that all of these nations were quite willingto30isolatetheintellectualpropertyrights(IPRs)ofothernations,evenwhentheyhadputin place laws protecting the IPRs of their own citizens. Examples include hiring illegal foreignlabor, smuggling machinery, industrial espionage, violating trademark laws, allowing thepatenting of imported inventions, and outright refusing to adopt the patent system (in the caseof the Netherlandsand Switzerland) relatedto life science and especially biotechnology.Some nations approached this issue in ways that can only be described as contradictory. Thebest examples include the routine infringement of British trademarks by German producers inthe late 19th century, when the nation was pressuring Switzerland to enact a patent law, andthe US pressing other nations for the "improvement" of their patent laws in the lead-up to theadoption of the Paris Convention while flatly refusing to protect foreign copyrights related tolife science and especially biotechnology. We talked about the issues with the dominant IPRregime that is now in place, which is centered on the patent system, and the TRIPS agreementthat represents its apex. Contrary to popular belief,a "good" IPRs regime need not providethe strongest protection for private IPRs. Next, we looked at whether developing nationswould likely gain from a stronger PIPRs system, particularly the one required under theTRIPS. Given that most developing nations do minimal R&D and that much of the newinformation they produce is not patentable, the "domestic" advantages of a stronger IPRssystem—that is, an increase in knowledge production by the citizens—are probably relativelyminorrelatedto lifescienceand especially biotechnology.

Keywords: Intellectualpropertyrights,economic,Development,TRIPS,

1. Introduction

The function of intellectual property rights (hereafter, IPRs) in economic growth has longbeen debatable, as will become obvious later in this article. But since the Trade-RelatedIntellectual Property Rights (TRIPS) Agreement, the dispute has only gotten hotter. TRIPSinitiallyreceivedlittle attention becauseitwasnot evena primarytopic intheUruguayRound of the GATT negotiations that resultedinthe establishment of theWorld TradeOrganization(WTO)(Siebeck,1990a).However,aseriesofrecentoccurrenceshavecoincidedto make people comprehend that this could end up being the main bone of contention in theWTO's operation in the years to come related to life science and especially biotechnology.TRIPS was first brought to the public's attention because, with the exception of the leastdevelopedcountries,whoweregivenuntil2006,the"transition"periodthatalloweddeveloping nations to "upgrade" their IPR regimes in accordance with the TRIPS Agreementwas comingtoanendandplacingthematgreaterriskoftradesanctionsbydevelopednations .

Second,recentattemptsbyindividualsandcompaniesinadvancednationstopatentgoodsthatincorporate information that is well known in certain poor countries have outraged many (forexample, the infamous turmeric case; see UNDP, 1999, pp. 70–1) related to life science andespeciallybiotechnology.Third,therecentcontroversyoverpharmaceuticalcompanies'attempts to use TRIPS to stop some developing nations (such as Argentina, India, Thailand,and Brazil) from exporting affordable AIDS/HIV drugs has brought attention to the potentialtension between TRIPS and promoting human welfare. Due to the fact that TRIPS, like otherWTO accords, is an agreement on a legal framework, its specific mode of operation must befigured out as more cases are amassed related to life science and especially biotechnology.This makes it impossible to say with precision what the TRIPS regime will look like exactlyinthefutureatthistime.Butastheaforementionedinstancesdemonstrate,thesystemappearsto be growing in a way thatprioritizesadvanced nation producersabove everyoneelse (including consumers in both advanced and developing countries and producers frompoor countries). Therefore, it is time to reconsider the implications of TRIPS and determinewhether and how they might be amended to improve everyone's wellbeing.In this essay, weattempt to add to the discussion by reexamining the function of intellectual property rights(IPRs) in economic growth and by outlining potential implications for a TRIPS agreementrevision related to life science and especially biotechnology. This paper's unique aspect is thatitattemptstoaccomplishthisbothhistoricallyandfromthestandpointofmodernemerging nations. The first section will analyses the role that intellectual property rights (IPRs) playedin the industrialization of the now-developed countries and make some implications for thedevelopingnationsoftodayandthefuture.presentsadebateonIPRs'significanceineconomic growth in the modern setting, with a focus on the patent system in particular. Theramifications of TRIPS are then critically examined in the chapter that follows in light of theearlierdebate.Thelastpartsummariesandendstheessayrelatedtolifescienceandespeciallybiotechnology.

2.Literaturereview

Table 1 :Review of literature

Authors	Paper	Country	Period	Datasource	Methodology	Typeoffirm	Number offirms
Arundel(2001)	TheRelativeEffectivenessof PatentsandSecrecyforAp propriation	Europeancountries	1993	CIS	Orderedlogitregressions	R&Dperformingfirms	2849
ArundelandKabla(1998)	WhatPercentageofInnovationsare Patented?Empirical EstimatesforEuropeanFirms	European countries	1993	PACEsurveyandSESSI survey	Simpleorderedlogit model	LargestR&Dperformingindustrial firms	604
Baldwinet al(1998)	InnovationinDynamicServiceIndustries	Canada	1996	Statistics Canada'sSurveyofInnovation	Descriptivestatistics	Firmsfromthreesectorsofthe serviceeconomy:communications,financialservicesandtechnicalbusinessservices	Communicationsfirms(excluding postalservices):895; banks andtrustcompaniesandlifeinsurers: 160 firms;businessesengaged incomputerorrelated services,offices ofengineers,andotheretechnical services:3,830
Basant(2004)	Intellectual PropertyandInnovation.ChangingPerspectivesintheIndianIT Industry	India	2004	Gupta,2004	Descriptivestatistics	ITfirms	120
Blind etal(2003)	Patentsin theServiceIndustries	Europeancountries	1998-2000 and2001	SecondCommunityInnovationSurvey	Descriptivestatisticsandcase studies	Servicefirms	65
Blind etal(2006)	MotivestoPatent:EmpiricalEvidence fromGermany	Germany	2002	QuestionnairetoGermanenterpriseswhichhadappliedfora minimumnumberofthreepatentsatthe EPOin1999	Factoranalysisandmultivariateprobitanalysis	Firmsthatin1999hadappliedforaminimumnumberofthreepatents	Over500
Brouwer andKleinknecht(1999)	InnovativeOutput,andaFirm'sPropensity to Patent. AnExplorationofCISMicroData	Netherlands	1992	Dutch partoftheCommunityInnovationSurvey (CIS)	Multivariateanalysis	Firmswith10andmoreworkersin allmanufacturingsectors	1,300
BymaandLeiponen(2007)	Can'tBlock, MustRun:SmallFirmsandAppropriability	Finland	2002-03	Surveydatacollectedby ETLA	Simple probitandmultinomiallogit models	Small andmedium-sizedfirmsin alleconomicsectorsexceptagriculture, finance,andrealestate	312

ChabchoubandNiosi(2005)	ExplainingthePropensitytoPatent ComputerSoftware	US andCanada	2000-02	Differentdatabasesprovidingfinancialinformationandthe USPTOdata on softwarepatents	Logisticregressionanalysis andlinearregression	Computersoftware-producingcompanies	Over1,700
Cincera(1997)	Patents,R&DandInternational Spillovers atthe FirmLevel:SomeEvidencefromEconometricCountModels for PanelData	Europeancountries	1983-91	EPOdatabase, Compustat(StandardandPoor's)and thefirms'annualreports	Poisson,countpanel data,GMMpaneldata	International manufacturingfirmsinvestingsubstantialamountsinR&D	181
Cohenetal(2000)	Protectingtheir IntellectualAssets:AppropriabilityConditions and Why USmanufacturingFirmsPatent (orNot)	US	1994	Surveyquestionnaireto R&Dmanagers	Factoranalysis	Manufacturing firmsthatperformR&Dwithatleast5million US$insalesormorethan20 employees	1,165
Cohenetal(2001)	R&DSpillovers,Patentsand theIncentivestoInnovateinJapana nd theUnitedStates	USandJapan	1994	SurveyofmanagersofR&Dunitsofmanufacturingfirmsinthe USandJapan	Weightedlogisticregression	ManufacturingfirmsthatperformR&D(US)andfirmswithcapitalizationover 1billionyenconductingR&D inmanufacturingindustries(Japan)withannualsalesof50 millionUSDorabove	826(US)and593 (Japan)
CombeandPfister(2000)	PatentsAgainstImitators:An EmpiricalInvestigationonFrench Data	France	1993	SESSIappropriationsurvey	Multinomialorderedlogitmodels	Innovativemanufacturingfirms	950

3.Technologytransfer,IPRsandeconomicdevelopmentin ahistoricalperspective:

Technology transfer has always been important in the history of industrialization. Britain'stransformationfromabackwardproducerofrawmaterialstoatopindustrialpowerthroughoutthe 16th and 17th centuries depended heavily on technology transfer from the continent's thenmore developed economy, particularly Venice and the Low Countries (Reinert, 1995; Cipolla,1993) related tolifescience andespecially biotechnology. The efficiency of technologytransferfromBritain(andtoalesserextentfromtheLowCountries)aftertheBritishIndustrialRevolution became the primary determinant of a country's prosperity (Landes, 1969 is thedefinitiveworkonthetransferofBritishtechnologytotheContinentalEuropeancountries;seeJeremy, 1981, on the transfer to the US) related to life science and especially biotechnology.Itseems clear that some of these transactions were organized through "legitimate" methods. Anexpert-led tour of a factory during the early stages of industrialization, when the technologiesused were reasonably easy to grasp, might be sufficient to convey the essence of technology.However, some highly developed producers refused to offer such tours from the start or at thevery least kept some information from the tourists that they felt was important. Anotherpopular method for absorbing cutting-edge foreign technology was through apprenticeshiprelatedtolifescienceandespeciallybiotechnology.However,untilthemiddleofthe19th century, when machinery became the primary embodiment of technological knowledge, thetransferofskilledpeople,inwhomthemajorityoftechnologicalinformationwasthenembodied, was the most significant method of technological transfer As a result, nationsattempted to hire qualified laborers from the more developed nations and also bring homecitizens who were working in other nations' businesses. Thisendeavor was occasionallycoordinatedandbackedbythegovernmentrelatedtolifescienceandespeciallybiotech nology

RoyaltyandLicensingfees,World(1950-2003)

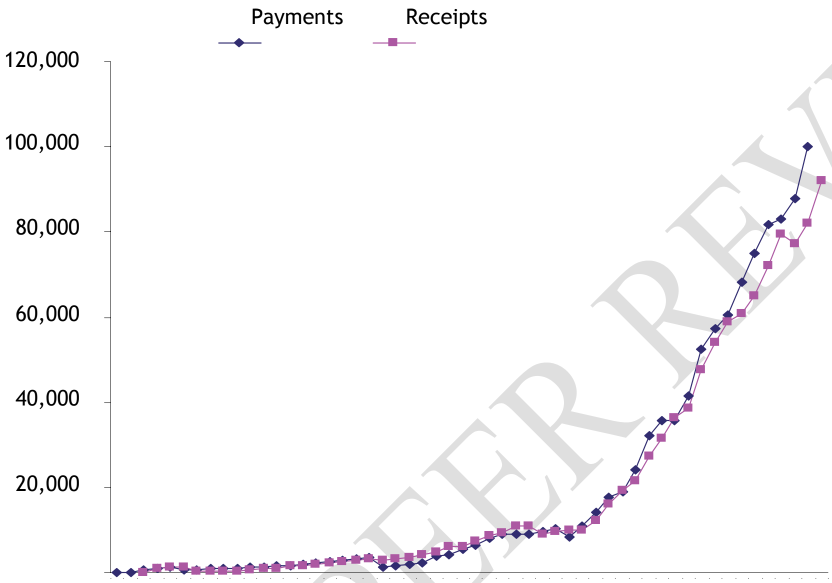

Fig 1 :Graph showing Royalty and licensing fees scenario

It goeswithout saying that these initiativeswere most successful when they were supportedbythepoliciesdesignedtoimprovewhatcurrenttechnologyeconomicsreferstoas"techno logical capabilities" (see Fransman & King (eds.), 1984). Many governments createinstitutions for research (like different non-teaching academies) and instruction (like technicalschools) related to life science and especially biotechnology. They also took steps to increase"awareness" of cutting-edge technologies in various ways. They set up museums, plannedinternational expositions (or "expos"), gave private businesses new machinery, and built"model factories"utilizing cutting-edge technology. Additionally, these governments gavethe businesses financial incentives to adopt more modern technologies, particularly throughrebates and duty-free imports of industrial equipment related to life science and especiallybiotechnology.

It should be mentioned that the purchase of superior technologies was frequently organizedvia"illegal"methods.Naturally,businessessoughttokeeptheirtechnologyasecret,sothey restricted access for outsiders to their plants. Furthermore, the governments of the moredeveloped nations were crucial in preventing the export of important technology (although itis questionable how effective they were in doing so) related to life science and especiallybiotechnology.Thegovernmentsofthemoredevelopednationsfocusedprimarilyonregul ating skilled worker movement during the early stages of industrialization since skilledemployees were then the embodiment of the majority of technology. Britain introduced a banon the migrationof skilledworkers, andespeciallyon attempts torecruit such workers forjobsabroad("suborning"),in1719,spurredprimarilybytheFrenchattempt(organizedbythe legendary Scottish-born financier John Law of the Mississippi Company fame) to recruithundreds of skilled workers related to life science and especially biotechnology. This statutemade suborning a crime that might result in a fine or perhaps prison time. Emigrant workerswouldeffectivelyforfeittheirrighttolands andpropertyinBritainandlosetheircitizenshipiftheydidnotreturnhomewithinsixmonthsofreceivi ngawarningtodosofromanauthorizedBritish authority (often diplomats stationed overseas). Industries including wool, steel, iron,brass or any other metal, and watchmaking were specifically specified in the statute, but inpracticetheruleappliedtoallindustries(forfurtherinformation,seeJeremy,1977,andHarris,1998, ch. 18). Up until 1825, suborning and the emigration of skilled laborers were prohibited(Landes, 1969, p. 148).As a result, machine exports were under control as more and moretechnology were incorporated into them related to life science and especially biotechnology.

In1750,BritainpassedanewActthatstrengthenedthepenaltiesforsubornationwhileoutlawingthe export of "tools and utensils" used in the wool and silk industries. In later laws, theprohibitionwastightenedandmademorecomprehensive.AnotherActwasintroducedin1774tor egulatetheexportofmachineryusedinthecottonandlinenindustries.Thelanguage"toolsandutensils "inthe1774Actwasamendedto"anymachine,engine,tool,press,paper,utensilor implement whatsoever" in 1781 to reflect the growing mechanization of the industriesrelatedtolifescienceandespeciallybiotechnology.TheToolsAct, whichcontainedarestriction on suborning, wasadopted in 1785 to prohibit the export of certain types ofmachinery(Harris,1998,p.457–462;alsoseeJeremy,1977).AccordingtoLandes(1969),thisprohibition persisted until 1842 related to life science and especially biotechnology. The lessdevelopednations useda varietyof "illegal" methods to obtainmoderntechnologiesinreaction to these steps taken by the industrialized nations to stop the transfer of technologyoutside related to life science and especially biotechnology. Entrepreneurs and technicians inthesenationsfrequentlyparticipatedinindustrialespionage,frequentlywithexplicitgovernmentalapprovalorevenactiveencouragement(suchasrewardsforobtainingcertain technology).Numerousstudies,includingthosebyLandes(1969),Harris(1991),andBruland (1991), describe a wide variety of industrial espionage against Britain carried out bynationsincludingFrance,Russia,Sweden,Norway,Denmark,theNetherlands,andBelgium.Itwa sdifficulttocatchuptechnologicallydespiteallthese"legitimate"and"illegitimate"attemptsrelatedt olifescienceandespeciallybiotechnology.Technologycontains a lot of tacit information that cannot be easily shared, as the most current research ontechnology transfer demonstrates. Even in the days when they embodied the majority of thecritical technologies, this challenge was not readily remedied, even by the importation ofexperienced employees. These folks had issues with their native tongues and cultures, butmore crucially, they lacked access to the same technological infrastructure that they did backhomerelatedtolifescienceandespeciallybiotechnology.Eveninthedayswhentechnologies were relatively simple and a technological follower could theoretically replicatewhat the leader was doing by importing some skilled workers and perhaps a key machine,Landes (1969) documents how it took decades for the Continental European countries toassimilateBritishtechnologies.Bythelate19thcentury,technologytransfer(andinformation transmission in general) were heavily reliant on whether or not patents and otherintellectual property rights were observed related to life science and especially biotechnology.By the middle of the 19th century, Britain's export restrictions on machinery and skilledworker migration had been abolished due to their growing inefficiency. By the middle of the19th century, the most important technologies had advanced to the point that mastery of themcould no longer be attained simply by importing machinery and skilled labor. An activetransmission of technological information by the owner through the licensing of patents hasbecome a major conduit of technology transfer in several fields related to life science andespeciallybiotechnology.

Table 2 :transmission of technological information

	Capital-intensive exports		Skill-intensive exports		High-technology exports		Royalties		NetFDIoutflows	
Value($bn)	**1990**	**2021**	**1990**	**2021**	**1990**	**2021**	**1990**	**2021**	**1990**	**2021**
Highincome	45.8	1,108.0	43.7	736.7	25.8	739.3	2.8	71.2	6.9	472.1
Lowincome	2.8	32.8	2.4	13.1	1.2	16.1	0.0	0.02	0.3	8.1
Lowermiddleincome	8.4	183.4	5.7	60.0	3.5	104.3	0.0	0.7	0.9	105.6
Uppermiddleincome	7.7	318.0	5.2	126.9	3.8	200.0	0.0	1.8	0.6	69.4
Sub-Saharanstates	1.5	10.6	1.5	6.0	0.7	5.6	0.0	0.02	0.1	5.5
Shares (%)										
Highincome	70.8	67.5	76.6	78.7	75.4	69.8	99.7	96.7	79.9	72.0
Lowincome	4.4	2.0	4.2	1.4	3.5	1.5	0.0	0.0	3.2	1.2
Lowermiddleincome	12.9	11.2	10.0	6.4	10.1	9.8	0.0	0.9	9.9	16.1
Uppermiddleincome	11.9	19.4	9.1	13.5	11.0	18.9	0.0	2.4	7.1	10.6
Sub-Saharanstates	2.3	0.6	2.8	0.6	2.0	0.5	0.0	0.0	1.2	0.8

Exports of Capital-Intensive, Skilled Labor-Intensive and Technology-Intensive Goods, Royalty IncomeEarned and Net FDI Outflows from High-Income OECD Countries, 1990 and 2021 (billion US$ andpercentage)

The majority of today's industrialized nations formed their patent laws between 1790 and1850, and they established additional components of their IPR regimes, such as copyright andtrademarklaws,whichwerefirstenactedinBritainin1709and1862,respectively.Bytoday'sstandards, each of these IPRsregimeswasincredibly "deficient."Many nations'patent laws lacked disclosure requirements, were extremely expensive to file and processpatent applications, and provided the patent holders with insufficient protection related to lifescienceandespeciallybiotechnology.Fewofthempermittedpatentsonchemicalandmedicinal materials (as opposed to procedures), a practice that several nations persisted longinto the 20th century. The fact that these laws provided only very insufficient protection forforeign people' intellectual property rights is extremely relevant to this subject (for moreinformation, see Williams, 1896, Penrose, 1951, Schiff, 1971, McLeod, 1988, Crafts, andSokoloff & Khan, 2000) related to life science and especially biotechnology.For instance,many patent laws have relatively loose standards for determining an invention's originality.More significantly, patenting of imported inventions by citizens was frequently expresslypermittedinthemajorityofnations,includingBritain(untilthe1852reform),theNetherlands, Austria, and France. Prior to the 1836 revision of the patent law in the USA,patents were issued without any justification for uniqueness. This prompted racketeers toengage in "rent-seeking" by patenting gadgets already in use (called "phoney patents") andcollecting money from their users under fear of legal action for infringement (Cochran &Miller,1942,p.14)relatedtolifescienceandespeciallybiotechnology.Thisnotonlyresulted in the patenting of foreign inventions.Even more consideration should be given tothe patent law disputes involving Switzerland and the Netherlands (see Schiff, 1971 for moreinformation). The Netherlands, which first enacted a patent legislation in 1817, did away withitin1869,inpartbecauseitwasfairlyinadequate(evenbythestandardsofthetime)10,butit was also a result of the broad anti-patent campaigns that were taking place in Europe at thetime.Accordingtothismovement,patentswerenodifferentfromothermonopolisticpractices (Schiff, 1971; Machlup & Penrose, 1951, provides a detailed account of the anti-patent activities of the time) related to life science and especially biotechnology. Up until thepassageofapatentlegislationin1888thatexclusivelyprotectedmechanicalinventions (defined as inventions that could be represented by mechanical models; Schiff, A patent lawdeserving of the term didn't exist until 1907, in part due to the fear of trade sanctions fromGermany in reprisal for the Swiss exploitation of its chemical and medicinal innovations.Even this, however, had a number of exceptions, most notably the denial of patents forchemical compounds (as opposed to chemical processes) related to life science and especiallybiotechnology. Chemical compounds were not patentable until 1978 (Patel, 1989, p. 980), butthe Swiss patent law didn't catch up to those of other developed nations until 1954 (Schiff,1971). The need for a worldwide IPRs system inevitably began to increase as more and morenations passed IPRs laws in the late 19th century (the following information is from Penrose,1951,chapter3).The1873ViennaCongressrepresentedthefirsteffforttoestablishaworldwideIPRsframeworkrelatedtolifescienceandespeciallybiotechnology.The"compulsory working" rule that Austria and some other nations possessed—in the Austrianexample, a patented item had to be manufactured in Austria within a year of the patent'sissuance or the patent would be revoked—raised significant controversy at this Congress.Despite opposition from several nations, most notably the USA, the Congress ended with aresolutionthatsuggested"compulsorylicensing"ratherthan"compulsoryworking."

In 1878, there was yet another convention in Paris. It was another "unofficial" event withoutany official government delegates, similar to the Vienna Congress. It was, nevertheless, ahighlypro-patenteeassembly,unliketheViennaCongress.Itsresolutiondid,however,acknowledge certain "public interest" reasons and supported the idea of mandatory labor. Acommission was established by the Paris Congress of 1878, and it finally produced a draughtconvention that was considered during the first "official" conference on the international IPRssystemin Parisin1880relatedtolifescienceandespeciallybiotechnology.TheParisConvention of the International Union for the Protection of Industrial Property was ultimatelyratified by 11 nations in Paris in 1883 (the original signatories were Belgium, Portugal,France, Guatemala, Italy, the Netherlands, San Salvador, Serbia, Spain, and Switzerland). Itencompassed not just patents but also trademark regulations (allowing Switzerland and theNetherlands, who lack patents, to join the Convention despite this). The Berne Convention oncopyrights was ratified in 1886. The Paris Convention, together with the Berne Convention,has served as the cornerstone of the international IPRs system up until the TRIPS Agreement.Subsequent revisions to the Paris Convention, most notably those made in 1911, 1925, 1934,1958,and1967,strengthenedpatenteerightsrelatedtolifescienceandespeciallybiotechnology.

There were several traits of the Paris Convention (Penrose, 1951). First off, it firmly chose a"non-reciprocity" policy, where foreign residents got national treatment but nations were notcompelled to provide them the same IPRs that they had in their home countries, in spite ofsignificant US opposition. Second, it recognized the "right of priority," which provided theapplicanttherighttohavehisorherclaimrecognizedinallothernationswheretheapplicant's invention qualified for patent protectionafter submitting a patent applicationinone of those nations related to life science and especially biotechnology. Most Importantly, itembraced both mandatory licensing and mandatory working. In 1925, the mandatory workingagreementwasalteredtoonlybepermissibleifforcedlicensingprovenineffectual.

Even the most developed nations continued to habitually violate the citizens' IPRs far into the20th century, despite the establishment of a worldwide IPRsframework. We have said thatthe Netherlands and Switzerland did not have a patent law prior to this period. It is alsonoteworthy that the USA, which was a staunch supporter of patentee rights even then, did notrecognize foreign copyrights until 1891 related to life science and especially biotechnology.There was also significant worry in Britain over German trademark infringement as recentlyas the late 19th century, when Germany was on the verge of technologically surpassingBritain(Williams,1896,providesmanyfascinatingdata;alsoseeLandes,1969,p.328).

Kindleberger (1978) observes that despite the absence of a trademark law in Britain until1862, "a number of British manufacturers were continuously engaged in litigation to protecttrademarks". It established a trade mark legislation (the Merchandise Mark Act) in 1862 thatoutlawed "commercial thievery" including the falsification of trademarks and the labeling offakeamounts.Thelocationorthecountryofproductionwasdeliberatelyinsertedasacomponentoft herequired"tradedescription"bytheBritishParliamentinthe1887modification of the Act in response to German (and other foreign) trademark law violation.This modification outlawed deceptive statements as well as descriptions that were obviouslyuntrue, such as the then-common practice in Germany of selling Sheffield silverware withbogus emblems related to life science and especially biotechnology. This Act stated that "itapenal offence to sell an article made abroad which has upon it any word or mark leading thepurchaser to believe that it is made in England, inthe absence of other words denoting therealplaceof origin"(Williams, 1896, p. 137).

TheGermans,however,usedavarietyofstrategiestocircumventthis

Act(Williams,1896,p.138).Thecountryoforiginstampwasplacedonthepackagingratherthantheac tualitems, making it impossible for purchasers to determine the country of origin of the goods once thewrapping was removed (reported to be typical among imports of watches and files). related tolife science and especially biotechnology. Additionally, they transported certain items inparts and had them put together in England (a practice allegedly frequent with pianos andcycles). Additionally,theywouldputtheorigin country'sstampinaveryunnoticeablelocation.Alloftheaforementionedargumentshighlighthowignorantmany TRIPSsupportersare regarding the historical significance of IPRs in fostering economic progress. For instance,the National Law Centre for Inter-American Free Trade, based in the US, claims that "thehistoricalrecordintheindustrializedcountries,whichbeganasdevelopingcountries,demonstratesthatintellectualpropertyprotectionhasbeenoneofthemostpowerfulinstruments for economic development, export growth, and the diffusion of new technologies,art, and culture" (National Law Centre for Inter-American Free Trade, 1997) related to lifescience and especially biotechnology.Contrary to this type of assertion, historical datademonstrates that IPRs, particularly those of foreign nations, were not properly recognizedthroughout the early stages of industrial growth in the modern-day affluent countries. Themodern emerging nations appear to be acting in many respects considerably better than thedeveloped nations of the past related to life science and especially biotechnology. And if thatis the case, it would seem unreasonable to expect modern-day developing nations to act inaccordance with a norm that was not even remotely met when the now-advanced nations werein the same or even farther along phases of development. Let's go to the following chapter,where we explore the significance of IPRs in economic growth in the modern setting, keepingthishistoricalbackdropinmindrelatedtolifescience andespeciallybiotechnology.

4. Intellectualpropertyrightsandeconomicdevelopment

People who support TRIPS contend that increased intellectual property rights protection isnecessary for the creation of new knowledge and, consequently, for economic growth. Whentheydiscussintellectualpropertyrights, however,they donotdistinguishbetween thevarious typesofIPRsandpresumethatallIPRsare,andshouldbe,"private"IPRs.Butthisisincorrect.

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Thosewhofailtodistinguishbetweenvarious IPRtypestacitlybelievethat reeafor-allopen access regime is the sole option in place of private intellectual property rights (PIPRs). Manybits of information, however, actually belong to the public or the community and must followstrict usage and disposal guidelines related to life science and especially biotechnology. Forinstance, the private-sector partners in a publicly-financed research consortia may be requiredtosharetheresultingpatentswithotherprojectparticipantsinadditiontomakingalloftheir discoveriespublic.Itispossiblethattherearelawsandsocialconventionsgoverningtheuseofspecific forms of information for specific purposes even in circumstances that appear to becompletely "open access" situations. Another illustration is the "open access" philosophy thatmany web-based software applications employ, which forbids individuals from using theresulting (better) goods related to life science and especially biotechnology. Therefore, ratherthandiscussingIPRsas a whole,we needmakea distinctionbetweenthe variousIPRsubtypes.Thisalsoimpliesthatthosewhoadvocatefor"stronger"IPRsareactuallyadvocating for stronger PIPRs when they speak of the importance of IPRs for the creation ofnew knowledge. But is it accurate to say that in order to encourage the creation of newknowledge,weneedPIPRsthatarefiercelyprotected?Istheuseofpatentsandother"monopolies" necessary? is another topic. Let's look at each of these concerns individuallyrelatedto lifescienceandespecially biotechnology.

4.0. Thecaseforand againstprivateIntellectualPropertyRights

Although it is currently widely accepted that PIPRs are an integral component of a marketeconomy, this was not always the case globally or historically. For a theoretical explication ofthis idea, see Chang, forthcoming. In other words, there are the historical and geographicalspecificities of the dominant view on what may and cannot be owned. The best illustration ofthis point comes from Thomas Jefferson, the third president of the United States, who arguedthat ideas cannot, by their very nature, be contained or exclusively appropriated and that, as aresult, "inventions... cannot,in nature, be a subject of property" (citedin Penrose,1951, p.23)relatedtolifescienceandespeciallybiotechnology.Giventhatheownedslaves,Jeffersoncertainly had no issue with individuals being owned, but he opposed the ownership of ideas,which is the exact contrary of what many people now think. Others opposed the notion ofgranting individuals PIPRs because they thought that any type of monopoly is evil, notablythoseconnectedtothemid-19thcenturyanti-patentmovementinEurope(Machlup&Penrose,1950,pp.18–9)relatedtolifescienceandespeciallybiotechnology.Aswepreviously discussed, the Netherlands formerly did away with their patent legislation for thisreason. However, later it was argued that while if PIPRs undoubtedly lead to inefficiencies,theyareacostsocietymustbearinordertobothencourageindividualstoworkhardoncomingup with new ideas and to encourage those who already have them to share them with others.These justifications, however, are not as strong as they seemrelated to life science andespeciallybiotechnology.

4.1. PIPRsasanincentiveto generatenewknowledge

It should be first noted that individuals frequently pursue knowledge for its own purpose,therefore they do not always need the financial incentives provided by PIPRs, in order tocounter the claim that PIPRs are required as incentives for innovative activity. In certaincases, such as the development of web-based computer software, open access has promotedrather than hindered the creation of new information, according to the UNDP (1999) (p. 72-3).Moresignificantly,theinnovatorcanbenefitfromseveral"natural"protectionmechanisms even without patents, which will allow them torealize significant financialrewards related to life science and especially biotechnology. The "imitation lag" (caused bythe expense of acquiring new information), the "reputational advantage" (of being the first tocreate), and the head start in racing down learning curves are some examples of these naturalprotective mechanisms (Scherer & Ross, 1990, p. 627). This was a common criticism ofpatents in the 19th century (Machlup & Penrose, 1950, p. 18), and Schumpeter's theory of"creative destruction" (Schumpeter, 1987) was based on it. In fact, a study by Levin et al.(1987) based on a poll of 650 high-level R&D managers of publicly traded companies in theUS discovered that patents are viewed as being much less significant than other "efforts" likesales or service effort in addition to "natural advantages" like imitation lag and the ability tomovedownthelearningcurvemorequicklyrelatedtolifescienceandespeciallybiotechnology.

The poll also revealed that even secrecy was seen as being more crucial thanpatents in maintaining the edge when it comes to process innovation. Mansfield (1986) askedthe senior R&D executives of 100 US companies what percentage of the ideas they createdbetween 1981 and 1983 would not have been developed had they been unable to get patentprotection. This was an intriguing poll. Only 3 out of the 12 industrial groups polled had a"high" response (60% for pharmaceuticals, 38% for other chemicals, and 25% for petroleum).Andfortheremaining6questions,theresponsewasessentially"none"(0%forofficeequipment, 1% for primary metals and instruments, and 1% for textiles, motor vehicles, andrubberproducts)relatedtolifescienceandespeciallybiotechnology.AccordingtoMansfield'scalculations,thetotalratiocameouttobeapproximately14%,whichisarelatively low proportion. This includes 3 additional industries where the response might beregardedas"low"(17%formachinery,12%forfabricatedmetalgoods,and11%forelectrical equipment). Numerous other investigations were out in the UK and Germany alsosupport the findings of this study related to life science and especially biotechnology.ThehistoricalexperiencesofSwitzerlandandtheNetherlands,aswecitedabove,furt hersupport

thepatentsystem'sratherlittleimpactoninventiveactivity.Schiff(1971)cametotheconclusion that there is no indication that the absence of a patent system held these twocountriesbehindintermsoftechnicalgrowthafterconductingaveryinsightfulanalysisofthe two nations throughout their patent less periods (Evenson, 1990). In this perspective, adeeper examination of the Switzerland case is warranted. According to Schiff (1971), wholooked at international patent statistics (patents obtained by various nations in the majorindustrial economies) and other case-based studies, the Swiss were among the most inventivepeople in the world in the late 19th century despite the fact that their nation did not have apatent law related to life science and especially biotechnology. During this time, the Swissproduced several world-famous inventions, including the steam engine, the Honneger silkloom, milk chocolate, instant soup, stock cubes, and baby food.Additionally, he notes thatthere is no proof that the lack of a patent system served as an impediment to foreign directinvestmentandevenmentionsseveralsignificantinstances,particularlyinthefoodprocessing industry, where its absence was unquestionably a key factor in FDI (pp. 102–3).On the other hand, he demonstrates that the establishment of patent law in 1907 did not resultin a discernible rise in innovative activity. In the instance of Switzerland, he comes to theconclusion that, overall, the lack of a patent system actually aided the nation's industrialgrowth (particularly in sectors like dye, chemical, and electro-technical; see page 104) relatedtolifescienceand especially biotechnology.

4.2. PIPRsasanincentivetodisclosenewknowledge

According to Machlup & Penrose (1950, pp. 25–8), the notion that PIPRs are required for usto force the creators of new ideas to divulge their new knowledge has been challenged. Firstoff, Bell and Wallace applying for patents for the telephone on the same day serves as proofthatevenifaninventorwithholdshisnewknowledge,societywillnotsufferbecause"usually the same or similar ideas are developed simultaneously and independently in severalquarters." Second, it is impossible to keep any innovation a secret for a very long period sincereverse engineering is used to develop new ideas, especially by those who were near todiscovering the same answer, even if there will unavoidably be imitations related to lifescience and especially biotechnology. Third, "where an inventor thinks he can succeed inguarding his secret, he will not seek patent protection; consequently, patent protection doesnotcausedisclosureofconceal-ableinventionsbutonlyservestorestricttheuseofinventions that could not have been kept secret anyway" (p. 26). Fourth, the patent system"encouragessecrecyinthedevelopmentalstageofinventionssincepatentsareonlygranted on inventions developed to a stage at which they can be reduced to practical use related to lifescienceand especially biotechnology."”.

4.3. Problemswiththecurrently-dominantIPRssystem

More particular, the IPRs regime that is now in place and is based on the patent system has anumber of issues. First off, as we mentioned above, it's unclear if patents are necessary inorder to create new ideas. Furthermore, the patent system has long been criticized for itspotential "wasteful-ness" Its "winner-takes-all" structure has been criticized for encouragingfierce rivalry that frequently leads to duplication of efforts and expenditures. Others havenoted that rather than producing "genuine" new information, resources may be squanderedtryingto"getaround"already-issuedpatentsrelatedtolifescienceandespeciallybiotechnology. Additionally, because technical advancement is cumulative and interactive,"strong protection of a key innovation may preclude the competitors from making sociallyuseful innovation" (Levin et al., 1987, p. 788). Many people also wonder why all innovationsshould have the same amount of legal protection, despite the fact that their societal usefulnessvaries, and why that protection should last for as long as 17 or 20 years related to life scienceand especially biotechnology. The above criticisms are all rather well-known, and we don’tneed to repeat them at length. Increasingly, however, there is a concern about the granting ofpatents and other PIPRs to certain inventions that were created by using the ideas generated bypublicly-funded research activities. This is a serious problem, when even according to theinformation provided by the Only 43% of pharmaceutical R&D is supported by the industry itself, according to the US Pharmaceutical Industry Association, while 29% is sponsored bythe National Institutes of Health (NIH) of the US government related to life science andespeciallybiotechnology.

For a more concrete illustration, consider the case of the anti-AIDS medication AZT, whichwas created in 1964 by a US researcher with funding from the National Institutes of Health(NIH). The UK pharmaceutical company Glaxo then purchased the medication for use on petcats. Because Glaxo declined to conduct the study, the NIH eventually completed all of theresearch demonstrating that AZT is effective against the HIV virus during the AIDS crisis.Despite the efforts of NIH, Glaxo is the company that is profiting greatly from the medicinesince it was quick to patent it after learning about AZT's impact on HIV (Palast, 2000).

WemayusethecaseofthecancermedicationTaxolasanadditional(evenmoresevere)illustrationrelatedtolifescienceandespeciallybiotechnology.Taxolhasnopatentbecause the US government made the discovery. Bristol-Myers Squibb, a pharmaceutical corporation,has complete control over the drug's pricing in Britain, but,as a result ofthe data privacylaw's10-yearprotectionofitstiny(thoughvitalinclinicalconditions)workondosecalculation. Another issue that is starting to surface is the potential that patents would impederather than advance development as ever smaller chunks of information become patented.related to life science and especially biotechnology This argument is well illustrated by thetechnological development of so-called "golden rice" (rice with added beta carotene), whichhas the potential to provide millions of people with significant nutritional advantages. IngoPotrykus(Swiss)andPeterBeyer(German),whoinventedthetechnique,statedthechallenges of negotiating for the estimated 70-105 patents as the main justification for sellingthetechnologytotheinternationalcorporationSyngenta(formerlyAstraZeneca).Whiledetractors point out that only a handful of the 6–9 patents listed by Potrykus and Beyeractually apply to nations where the golden rice would have significant advantages (see RAFI,2000), the case demonstrates how recent technological advancements have increased thedeterrentpotentialof patentsrelatedtolifescienceandespeciallybiotechnology.

4.4. Alternativestothecurrently-dominantIPRssystem

What are the potential alternatives, given all the issues with the prevalent IPRs system today?Needless to add, PIPRs might be completely eliminated. Note that this is not an argument forIPRs to be completely abolished (or for "open access"). Public rules and societal standardsregulating the use of ideas would exist under this system related to life science and especiallybiotechnology. The natural imitation gap will also continue to provide enough opportunity forprivate appropriation of new information. There are several different ways to innovation thatarecenteredon"sharing,openaccess,andcommunalinnovation,"asUNDP(1999)underlines.If eliminating PIPRs sounds risky, keep in mind that prior to the creation of patent laws, thiswas the implicit attitude of every nation. Nearly all nations have rejected PIPRs in certainsectors,evenafterthe patent system wasadoptedrelatedtolifescienceandespeciallybiotechnology.Forinstance,theyfrequentlydemandthattheknowledgeproducedbypubliclyfundingcertaininnovativeeffortsbeturnedovertothepublicdomain.Theproblemofpatentspreventing future technical advancement can also be solved by replacing them withlump-sum rewards, which will encourage individuals to invest in innovative activities. Indeed, thejournal Economist notably supported this idea, which was widely supported by anti-patentactivists in 19th-century Europe (Machlup & Penrose, 1950,

p. 19–22) related to life scienceandespeciallybiotechnology.Theproblemwiththisapproachisthatweeitherhaveto provideeveryinventorwiththesameprizeregardlessofthesocietalworthoftheirinnovations or we have to invest a lot of resources in deciding who deserves what size of aprize. We might adopt Scherer's (1984) idea, which is less spectacular but no less significantand unquestionably better groundedrelatedto life science andespecially biotechnology.AccordingtoScherer,"aflexiblesystemofcompulsorylicensing,wheretheburdenof proving that the patent should not expire or be licensed at modest royalties to all applicantsthree or five years after its issuance rests with the patent recipient" is the best option. Hecontendsthat "there would be a presumptionin favor of early patent licensing or expirationon the assumption that positive innovation profits could normally be attained without theaddedinducementofstrongpatentprotection"whenapatent-holdingcorporation"possessesa substantial share of the relevant market and well-established marketing channels related tolife science and especially biotechnology." Scherer admits that there can be technologies inwhichtheuncertaintiesaresogreatthatonlyextremelystrongpatentprotectionwillencourage the required expenditures. It should be possible to design policies that treat suchcases as exceptions, he says, by waiving the presumption infavorof earlycompulsorylicensing or short patent lives (for inventions with high ex post private benefit-cost ratios),provided that the patent recipient demonstrated exceptional creativity or undertook unusualtechnical and/or commercial risks during the inventions development.The point is that if ourultimategoalisfortechnologytospreadaswidelyaspossible,weneedto"buyoff"innovators at the lowest cost possible, and there are reasons to doubt that the dominant IPRsystem that is currently in place, which is based on the patent system, provides the most cost-effective method related to life science and especially biotechnology. It should be noted thattheadvantagesofanationalPIPRssystemmaybelowforemergingnations,wheretechnologicala bsorptionisfarmorecrucialthanthecreationofpatentabletechnology.Stronger PIPRs would produce fewer innovations since the economic actors in these nationslack the capacity to innovate. There is virtually little proof that higher PIPRs promote moreR&D in developingnations, asevenTRIPS supporter PrimoBraga(1996)acknowledges.The most crucial types of new information for emerging nations are, in fact, those that are noteasily patentable, according to current study on technological difficulties in those nations. Forthem, the most significant knowledge is not that which is truly "novel" on a global scale, butratherthatwhichismoretacitandlocalized,necessaryforassimilatingcutting-edgetechnologies(includingneworganizationalknowledge),andwhichcannotbepatented,except in very limited circumstances related to life science and especially biotechnology. Inordertopromotethis sortoftechnologicalgrowth,mostnations hadtoutilizepolicies suchas newborn industry protection and other industrial policy measures (as was the case in the 19thcenturywiththeUSandotherfollowingnations).Unfortunately,theWTOagreementcurrently places limitations on these methods, albeit perhaps not to the extent that is oftenthought (see Akyüz et al., 1998; Amsden, 2000; and Chang & Cheema, forthcoming) relatedtolifescienceand especially biotechnology.

On the other hand, given their lack of technical, administrative, and legal human resources,poor nations may face significant opportunity costs in setting up and maintaining a robustPIPRs system. Additionally, developing nations may be more affected than more developednationsbythe"monopoly"impactofpatentsduetoinadequateanti-trustlawsand/orenforcement capacity related to life science and especially biotechnology. Additionally, giventhat wealthy nations hold 97% of all patents worldwide (UNDP, 1999, p. 68), the expensesassociated with paying royalties may vastly outweigh the advantages of the (insignificant)additionalinformationthatthesystempullsfrompeopleinpoornations.Theproblems forpoornations are worse when there is an international system like TRIPS that requires compliancewith the international "norm" (with certain adjustments) related to life science and especiallybiotechnology.

5.Conclusion

Second, even from a more "technical" perspective, there should be a wider awareness thatdeveloping countries require IPR regimes that are fundamentally different from those thatexist in rich nations. The existing TRIPS system does acknowledge this to some extent,although it is severely limited, maybe with the exception of the "least developed countries".More assistance must be provided to emerging nations. It should be possible for developingnationstoreceive lesserPIPRs(suchas shortenedpatent lifespans,simplercompulsorylicensingandworkingrequirements,andsimplerparallelimports)an dtopayreducedlicensing royalty rates related to life science and especially biotechnology. Developed nationsshould be aware that an international IPRs framework that supports technical advancementand economic expansion in developing nations would increase demand for developed nationexports. They will thus gain more from it than from a regime that depresses emerging nationsinexchangeforasmallriseinroyaltypaymentsandasmalldecreaseinexportcompetitiveness for particular industries. There has to be a significant revision of the TRIPSframework related to life science and especially biotechnology. Without a change, it will overthenextseveralyearsgrowintoasignificantsourceofconflictinthenewlyformingglobal economic system. The world may eventually sink into chaos if a more equitable and dynamicglobal order is not established, as it did with the first globalization, which began in the late19th century and "ended" in three decades of war and the Great Depression related to lifescienceand especially biotechnology.

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