The History of Intellectual Property

Terence Kealey

Introduction to patents (and some early history)

The story of intellectual property starts with the introduction of the first systematic patent laws in Venice in 1474. Before 1474, according to Bruce Bugbee's authoritative 1967 book *The Genesis of American Patent and Copyright Law*, intellectual property was recognised only episodically. Thus it appears that the restauranteurs of Sybaris during the 5th century BC (or BCE) competed every year for a prize for the best novel recipe, and the winner was allowed a monopoly on the recipe for the following year. Bugbee describes other Greek and Roman examples of intellectual property, yet all are as economically marginal as the recipes of Sybaris, and only with the 1474 Venetian statute did intellectual property law first become systematised.

(The great Florentine architect Brunelleschi was awarded a patent in 1421 for a novel hoist, but that was a unique award by the Florentines and one they did not repeat during the 15th Century.)

The motive for the creation of the Venetian statute was the intensive glass manufacture of the lagoon, which inspired competitive invention, and which in turn led to demands from the glassmakers for the legal protection of their inventions. The 1471 statute was remarkably modern in its provisions, in that it (i) required the disclosure of the invention, (ii) prescribed a term limit on the duration of the patent, and (iii) prescribed penalties for infringers. The apparent modernity of the Venetian statute speaks of its influence on the English Statute of Monopolies of 1624, which is the Statute that forms the basis of contemporary patent law, internationally.

Curiously, the English 1624 Statute was not conceived primarily as an incentive for invention but, rather, as a restriction on the King, because it was passed by Parliament to restrict King James I who, like other monarchs before him, had granted monopolies on pre-existing trades (such as salt) to favoured clients. Outraged, the Parliamentarians in 1624 restricted all subsequent patents to novel inventions ("projects of new inventions.") The Statute of Monopolies, therefore – and slightly ironically in view of later controversies – was enacted primarily to limit the role of monopolies in the economy. Nonetheless the 1624 English Statute was inspired by the 1474 Venetian Statute because – as the glassmakers of Venice migrated all over Europe in search of markets – they spread their concepts of the legal protection of innovation with them.

Patents are so called because they were originally called

'letters patent', the word *patent* meaning 'open' as in 'patently obvious' from the Latin *patere* meaning 'to open.' When a patent was granted, it came in the form of a letter, with the wax seal being ornamental and not functional (i.e., the letter was not sealed but was open to be read freely.)

Modern copyright law is based on the English Statute of Anne of 1710, but I will leave it to Professor Stan Leibowitz to address that here. As for the other aspects of intellectual property (trade secrets, trademarks, the so-called 'law of ideas', creative commons, copyleft *et alia*) space here is limited and I refer to them only to explain that here I am focussing on patent law.

Patents are a form of property, and ever since Locke described the three fundamental rights of individuals under the law as being life, liberty and the protection of property, property rights have been properly venerated in the west. Nonetheless it is important to note that, important though property rights are, they are rarely unrestricted. Consider land. Freehold landowners are not sovereign, and all states – which of course *are* sovereign - reserve to themselves the ultimate ownership and use of land. Thus in many countries freeholders do not automatically own the mineral or overflying rights to their land, and in all countries governments can legally acquire land from freeholders without their consent if, in the judgement of the government, such an acquisition is in the public interest (in America this is called the law of eminent domain, in Britain compulsory purchase, etc.)

Equally, as a form of property, patent rights in invention are restricted: the US's Patent Acts (which date from 1790) to take a typical example, restrict the award of a patent only to an innovation that is (i) useful, (ii) novel, and (iii) non-obvious. Nonetheless, as a form of property, patents can be traded, and patent holders may sell all or some of their property, just as they may also grant licences to others to use part or all of their patents.

It is often said that patents provide an exclusive right to use or exercise an invention for a limited time in return for the disclosure of the invention. Actually, this is not true: patents provide an exclusive right *to stop others* from using or exercising an invention for a limited time in return for the disclosure of the invention. But in their turn others may be able to stop a patent holder from using or exercising their own invention. As we shall see, this apparently subtle or even pedantic point is important, and it goes to the heart of one of the contemporary controversies over patents.

The theoretical basis of the British (and international) patent system was summarised by TA Blanco White in his *Patents for Inventions*, quoted by the Banks Commission in its 1970 UK Committee of Enquiry's *Report on the British Patent System*:- "It is desirable that industrial techniques be improved. To encourage improvement and disclosure (in preference to secrecy) any person devising an improvement in a manufactured article, or in machinery, or in methods of making it, may upon disclosure of his improvement to the

Patents Office demand to be given monopoly in the use of it for 16 years."

(As White adumbrated, there are different classes of patent, and America – to take the prototypical international example of today – recognises three, namely [i] utility patents [for new processes, machines, artefacts and composition of matter], [ii] design patents [for designs for articles of manufacture] and [iii] plant patents [for novel plants as in horticulture or agriculture.] The periods of patent monopoly have varied over the centuries, and between different national jurisdictions and between different classes of patent, but currently in the US utility and plant patents extend for 20 years and design patents for 14.)

The later history of patents

As the Industrial Revolution accelerated in Britain and the Continent of Europe during the 19th Century, and as patents became an increasingly prominent part of business life, so a powerful movement of opposition built up against them. In Britain the opposition was led by prominent men such as Isambard Kingdom Brunel, while on the Continent of Europe other prominent men such as Bismarck were openly sceptical. The Victorian controversy over patents, which was chronicled by Adrian Johns in his 2009 book *Piracy: The Intellectual Property Wars from Guttenberg to Gates*, has been largely forgotten today, but it is worth recalling because

many of these earlier arguments are perennial and remain relevant today.

The criticisms of patents were inevitably complex, but for simplicity they can be reduced to six main themes. First, patents were a form of monopoly, and in an era of free trade (the British Corn Laws were repealed in 1846) private state-granted monopolies seemed retrogressive. Second, critics were sceptical about the specialness of invention: simultaneous invention of the same innovation by more than one inventor seemed (and still seems) to be a feature of technological development (hence all the bitter battles over priority, which remain of feature of research to this day) and technological invention thus seemed to be a collective matter that emerged out of a milieu of collective enterprise, so critics felt that no incentive was necessary to encourage invention. Third, critics indeed suggested that inventiveness was an innate feature of human beings, and thus needed no incentivisation. Fourth, individual inventions clearly built on the legacy of centuries or even millennia of progress, so critics argued that a patent holder – by inventing only the last in a long line of inventions – was unfairly appropriating the inventions of the past. Fifth, critics argued that industrial organisation and the creation and management of companies were the real limiting factors in economic development, and that patents conferred on invention an inappropriate level of importance. And finally, sixth, critics of patents argued that almost all patents were economically useless but that their possession – and the expectation of their possession

– raised unrealisable hopes in the hearts of most inventors, who would thus waste their lives in the fruitless search for return for their patents.

These arguments were judged to be so powerful that Britain very nearly abolished patents and, as Johns described in *Piracy*, but for certain parliamentary vagaries such as the timing and results of particular elections, Britain actually would have abolished patents. In two countries on the Continent of Europe the critics of patents did win the argument, and Switzerland in 1850 reaffirmed its earlier decision not to introduce patent laws while – most dramatically of all – the Netherlands in 1868 actually repealed its existing patent laws.

Nonetheless, most countries did operate patent laws, and their delegates congregated at the Paris Convention of 1883 to start the process of international harmonisation. Further, those countries that operated copyright laws sent delegates to the Berne Convention of 1886. The secretariats of those conventions were eventually fused into today's World Intellectual Property Organisation (an agency of the United Nations) and finally, simply for fear of being excluded from the newly emerging international trading treaties, Switzerland (in 1907) and the Netherlands (in 1912) introduced patent laws.

(The latest development in the international harmonisation of intellectual property was the Agreement on Trade Related Aspects of Intellectual Property Rights [TRIPs] which was

negotiated at the end of the Uruguay Round of the General Agreement on Tariffs and Trade [GATT] in 1994.)

Interestingly – indeed, importantly – as the economic historian Eric Schiff showed in his 1971 book *Industrialisation Without National Patents*, Switzerland's and the Netherlands' long term rates of economic or productivity growth were unaffected by these developments (which can be independently confirmed by examining those countries' long-term rates of economic growth in Maddison's 2003 book *The World Economy*) which suggests that patents – either in their observation or in their absence - are irrelevant to aggregate economic growth.

Schiff also chronicled at the anecdotal level that the lack of patent protection did not inhibit the technical fertility of Switzerland or the Netherlands. To take just one 14 year period in Switzerland, in 1866 Henri Nestlé developed a formula milk for infants, in 1869 Julius Maggi invented powdered soup, in 1875 Daniel Peter invented milk chocolate, and in 1879 Rudolf Lindt developed chocolat fondant. Those names still live in the companies that flourished patent-free on the back of those technologies.

The absence of patents did, of course, facilitate the import of technology. The Dutch precursor of Unilever created margarine during the 1870s by exploiting, licence-free, a French patent, and during the 1890s Gerard Philips in Holland built his company by manufacturing light bulbs without paying Edison a licence fee (Philips's first big order being,

ironically, to light a candle-manufacturing factory). Those companies have since produced important innovations of their own, thus showing how their intensification of research has benefited society at large.

One paradoxical example of the value of that research intensification was provided by the Swiss drug company CIBA (now part of Novartis) which was founded in 1869 in Basle to exploit, licence-free, the discovery of mauve and other aniline dyes that William Perkin had made in London two years earlier. Yet, as Simon Garfield showed in his 2001 book *Mauve*, it was the patent-free exploitation of mauve by Continental chemists that saved Perkin's own business! Perkin could not find investors in Britain, who did not believe that mauve was a profitable colour, and only after the Europeans started copying Perkin's technology to produce mauve gowns for Parisians (who *loved* them) did the ladies of London demand their own, thus impelling British investors into funding Perkin's business. Thus we see how competition – that patents are designed to inhibit – stimulates innovation.

The problem with patents

The fundamental problem with patents is that knowledge is not, innately, a private good, yet patents seek to privatise the innately public. A private good is defined as being both 'rival' and 'excludable.' A piece of land, for example is rivalrous, and if more than one person seeks to farm a piece of land,

the rivalry between the two people will reduce its output. So if one farmer places his animals on it to graze, and another farmer places his own animals on the same piece of land, then each farmer will have a private incentive to ensure his animals eat the maximum amount of food before the other farmer's animals do, and in a so-called 'tragedy of the commons' the land will be over-exploited and ruined.

But knowledge is non-rivalrous: a million people can use the same idea (the laws of gravity for example) and the idea is not weakened in consequence.

Furthermore, land is excludable. A private good such as a farm can be fenced, to thus exclude all others. Private goods, therefore, can be monpolised by owners, and they will thus attract investment. But ideas are only partially excludable because secrecy is hard to maintain. Patents attempt to achieve excludability by restricting the commercialisation of ideas in exchange for their publication, but should we be trying to restrict the commercialisation of knowledge? Knowledge is non-rivalrous, and society is clearly advantaged if everybody has access to all knowledge, so why create artificial restrictions on its application?

Patents do not incentivise invention

The answer to the question of "why create artificial restrictions on the application of knowledge?" is, we are told,

the incentivisation of invention. We are told that inventors will be incentivised to invent only if they can monopolise their inventions. But is this true?

Imagine an old-time baker in a world of old-time bakers. Faced with competition, he needs a novel product by which to increase his profits. So he invents one – sliced bread perhaps. To invent sliced bread, the baker takes out a bank loan, he (let us assume for simplicity that the baker is male) invests in research, he develops a mechanical slicer, and soon he will be selling his sliced bread at a vast profit because he is its only producer.

What will his competitors do? Some, stunned by the fall in their revenues and by his profits, will take up their own research. They will take out bank loans and employ researchers. Soon, someone will invent *thin* sliced bread (for sandwiches). That someone will then steal much of the first baker's profits.

At this point the defenders of patents will cry - unfair! "Poor first baker" they will wail, "someone has stolen his intellectual property. People developed thin sliced only because of the first baker's idea". Which is true, but thereafter the patent-defenders go awry. You and I know what the first baker will do next. He'll revisit his bank, take out another loan, research even more intensively than before, and develop *thick* sliced for toasting. Soon he will be enjoying huge monopoly profits as people buy his bread to make toast.

The various bakers will therefore create the best possible world for customers, perennially improving their products by their competitive research.

But the patent-defenders argue the opposite. They invoke a bizarre economic concept called the 'perfect market'. In perfect markets there are an infinity of producers, an infinity of consumers, an infinity of products, and no-one makes a profit. Perfect markets clearly bear little relation to real ones, but nonetheless - because the first baker's returns from the initial invention of slicing are lower than they would otherwise have been because someone invented thin sliced - 'perfect market theory' predicts that the first baker will research less than he would otherwise have done. Moreover, perfect market theory also suggests that the first baker will downsize his research and development (R&D) even further because he can anticipate his diminution at someone's hands: even if the first baker invents thick sliced, he knows that someone will soon invent muffins or some other market-stealer; and everyone else will do the same. They too will anticipate that others will acquire their ideas, so they too will research less.

Therefore, say the perfect markets theorists, competition will cause entrepreneurs to *reduce* their research budgets. Only patents will protect research by guaranteeing inventors a proper return on their investment in research and development (R&D.) Monopolies, in short, are good for the economy!

Except, of course, that the empirical evidence shows the opposite, namely that competition is the great spur of research. In a 2001 survey of 154 Spanish research-led companies, for example, the economist Isabel Busom found that the majority confirmed that they "would accelerate their own R&D effort if they found that a rival firm was doing similar R&D". Similarly, in a survey of agricultural R&D across the developing world, Carl Pray and Keith Fuglie of the US Department of Agriculture found that, even amongst poor countries, it is market competition that spurs private research:-

> The most liberal market economies of the 1980s – Thailand, Malaysia and the Philippines – had the highest private research intensities. The countries with the most controlled economies – China, Indonesia, Pakistan and India – had the lowest. The countries in which private research grew most rapidly – China, India, Pakistan and Indonesia – had major liberalisation programs during the mid-1980s.
>
> US Department of Agriculture,
> *Agricultural Economic Report No 805*, 2001

An intriguing episode in US history, namely the War of 1812, confirms that competition incentivises research. In 1812 the Americans attacked Britain over its continental blockade against Napoleon. But in 1814/1815 the Americans and British re-negotiated peace. It was the economic historian Kenneth Sokoloff (1988) who studied the peace following

the War of 1812 to test the effects of trade on the USA: the War had disrupted trade between British Canada and the USA for up to three years, but thereafter trade restarted; what were the consequences on the northern US counties adjoining Canada?

Sokoloff found that the resumption of trade prompted research and patenting. With each new incursion of trade after 1814, local businessmen started to patent. The sudden rises in local patenting, moreover, were not caused by influxes of inventors from Boston, New York and other areas of existing innovation, they were caused by local businessmen turning to research to defend their existing businesses against new competitors, and to exploit new markets to which the new trade routes had provided them with access. Competition, Sokoloff confirmed, stimulates research. As the head of R&D at Unilever used to say, his department's budget's best friend was the R&D department at Procter and Gamble.

We thus see that innovation is driven by competition, and that companies invest in research when faced with competitors. One contemporary economist who understands this is William Baumol of Princeton who wrote as the very first sentence of his 2002 book *The Free-Market Innovation Machine*:- "Under capitalism, innovative activity – which in other types of economy is fortuitous and optional – becomes mandatory, a life-and-death matter for the firm". This is because, as Joseph Schumpeter wrote in his 1942 book *Capitalism,*

Socialism, and Democracy, economic theories based on perfect markets and the price mechanism are unreal – in real life companies compete for monopolies by innovation:-

> In capitalistic reality as distinguished from its textbook picture, it is not that kind of [price] competition that counts but the competition from the new commodity, the new technology [...] which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the outputs of existing firms but at their foundations and their very lives.
>
> Page 84 of the 2nd, 1947, edition

We see here, therefore, the destruction of the idea that the perfect market model justifies patents. Markets are not 'perfect' (they are in fact oligopolistic, which is very different indeed) and entrepreneurs are not the profit maximisers of perfect market theory, they can be only profit-seekers, and the greater the competition the more they will invest in research to sustain their profits.

Humans, moreover, are complex, and they are incentivised by more than just money. Many scientists continue to make their work free, one example being Linux, the open-source software provided by Linus Torvalds and his merry band of fellow idealists. Another example is Wikipedia, provided by Jimmy Wales and his band of volunteers. Open source, of course, often outperforms the proprietary sector because of the contributions of the virtual community. Open source

thus challenges the assumption that innovators require IPR to be incentivised.

Patents do not disclose new information

The defenders of patents argue that patents promote disclosure. No they do not: industrial secrecy is a myth; in reality, company scientists trade information, which is thus disclosed speedily. In a survey of 100 US firms across a range of manufacturing industries, Mansfield and his colleagues found that:-

> Information concerning development decisions is generally in the hands of rivals within about 12 to 18 months on average, and information containing the detailed nature and operation of a new product or process generally leaks out within a year.
>
> Imitation Costs and Patents: An Empirical Study
> *Economic Journal* 91: 907-918, 1981

Surprisingly perhaps, competitor companies share information. In a survey of 11 American steel companies, Eric von Hippel (1998) of MIT's Sloan School of Management found that 10 of them regularly swapped proprietary information with their rivals. In an international survey of 102 firms Thomas Allen (1983) also of MIT's Sloan, found that no fewer than 23 per cent of their important innovations came from swapping information with rivals:- "Managers

approached apparently competing firms in other countries directly and were provided with surprisingly free access to their technology". In a 1997 cross-disciplinary study, Louis Galambos (Professor of History at Johns Hopkins University) and Jeffrey Sturchio (Vice President External Affairs, Merck Sharp & Dohme) have shown how pharmaceutical companies – though intense competitors – will also share knowledge.

Practical businesspeople have long known that rivals share information. It was the president of the Western Electronics Manufacturers' Association in the US who reported that competitors:- "share the problems and experiences they have had" (Saxenian, 1994). Some companies even boast of being good sharers:-

> Conventional business wisdom says: Never let the competition know what you're doing. But at Novell, we believe the secret of success is to share your secrets. So we established the Novell Labs Programme to openly share our networking software technology with other companies.
>
> Advertisement in *The Economist*
> 21 September 1991

Companies share knowledge for a number of reasons, but the most important is that those companies that share knowledge will outperform those companies that do not, because such sharing widens a company's knowledge base

and thus its opportunities. Plus the firms with which to share are those with the same specialist knowledge - rivals. Thus we see that modern scholarship confirms one concept of research held by Victorian critics of patents, namely that it is a collective enterprise by which discoveries emerge out of a milieu rather than being the achievements of uniquely self-sufficient geniuses.

Thus we see that we do not need patents to promote disclosure: there is no market failure in the exploitation of new knowledge; the12-18 months that Mansfield *et al* found is the time on average it takes for information to leak out, provides enough time to allow an innovator to consolidate his or her first-mover commercial lead, while being short enough to benefit society by empowering second-movers. In an ideal world, we would want inventors to be incentivised by a period of monopoly *and* we would want all information to be uniformly available, and the market appears spontaneously to square that circle.

Patents are rarely useful. Relatively few innovations are actually patented. In a systematic review of industry, Edwin Mansfield and his colleagues found that:-

> Patent protection did not seem essential for the development and introduction of at least three fourths of innovations.
>
> Imitation Costs and Patents: An Empirical Study
> *Economic Journal* 91: 907-918, 1981

Mansfield *et alia* found that patents increased the costs of imitation only to a minor degree. Empirical studies show repeatedly that *the* great defence of technological monopoly is 'first moving' – consistently providing the novel product that everyone wants to buy and for which consumers will pay premium prices; which therefore rewards the first mover with the profits by which to invest in the next innovation:-

> The picture is striking. For new processes, patents were generally rated [by 650 executives across a range of US industries] the least effective of the mechanisms of appropriation. [...] Lead time, learning curves, and sales and service efforts were regarded as substantially more effective than patents in protecting products.
>
> RC Levin, AK Klevorick,
> RR Nelson & SG Winter, 1987,
> Appropriating the Returns from Industrial R&D
> *Brookings Papers on Economic Activity* 3: 783-820

Cohen *et al* (2000) confirmed by surveying R&D managers that most inventions are not patented and that other means of appropriation are more effective than patents in obtaining return on R&D.

Patents can be damaging. Consider the airplane. Orville and Wilbur Wright flew the first manned heavier-than-air powered aircraft, *Flyer 1*, in 1903; and they patented it, which was the biggest mistake of their lives.

The Wright brothers were bicycle manufacturers from Dayton, Ohio, who invented the airplane in their spare time. They were amateurs. The person who felt he should have invented the airplane was a grander figure, Samuel Langley, the Director of the Smithsonian Institution. Since 1885 he had been trying to fly his own planes, *Aerodromes One* to *Six*, yet each had crashed on take off into the Potomac River, over which Langley launched his *Aerodromes* to allow his pilots a chance of survival. A reporter described the crash of October 7th 1903 as *Aerodrome Six* "entering the Potomac like a handful of mortar". Yet on December 17th Orville and Wilbur Wright took off at Kitty Hawk, North Carolina.

The Wright brothers had financed their own R&D (a mere $1000) whereas the Federal Government had provided Langley with a grant of no less than $73,000. The Federal Government then funded only military and agricultural research, but Langley had exploited the Spanish American War of 1898 to persuade Congress to finance him - only to have created, in the disenchanted words of one Representative, "a mud duck". Both the Government and the Smithsonian were therefore chagrined by the Wrights' success.

But the chagrin was soon aggravated by the Wrights' patents because, after the brothers' success with *Flyer 1*, other American aviators including Glen Curtiss soon built their own planes. But each time Curtiss or any other aviator took to the American skies, the Wrights sued for patent

infringement. Official America took Curtiss's side, and in court the Smithsonian and the relevant federal government agencies claimed, falsely, that the Smithsonian's *Aerodrome* had flown first. The Smithsonian even got Curtiss to adapt Langley's surviving *Aerodrome*, to show it could have flown; and for years the Wrights were reduced to protesting that it was only on being adapted in the light of later experience that *Aerodrome* (nearly) flew. But official America so denigrated the Wright brothers that in 1928, when Orville Wright (the surviving brother – Wilbut had died earlier) sought a museum for *Flyer 1*, he found no US institution prepared to take it, nor one to which he was prepared to donate it. He sent it instead to the British Museum in London. Only after Orville died in 1948 did the Smithsonian ask London for America's plane back - the Smithsonian did not want to give a Wright brother the satisfaction of knowing that it acknowledged his priority.

Yet this unpleasant story was not just one of frustrated *amour propre*: the Federal Government had legitimate concerns. The aeroplane was of strategic value, and the Europeans (who readily paid the Wrights' licence fees) were pulling ahead in aeronautics, but the US was threatened with obsolescence because the Federal authorities would not pay those fees. Because the Federal Government had funded Langley's research, it did not want to recognise its waste of money, and the Smithsonian colluded with the charade because it needed to sustain the credibility of future government grants.

If the Federal Government was determined not to pay the licence fees, it would have been more honest to have modified the relevant patent laws. Indeed, in a key episode, the Federal government *did*, as a war measure in 1917, revoke the Wrights' patent rights, a revocation that it sustained until 1975. Between 1917 and 1975, therefore, the federal government forced all American aeroplane manufacturers to pool their patents collectively – and the consequence was the vast growth of the US aeroplane industry. Thus we see that the Wright brothers' patents destroyed aeronautical innovation in the US, and that only on their revocation in 1917 did America's planes take off.

This story, moreover, is not just an anecdote, because the Wrights were not alone in their patent defence-induced misery: Eli Whitney (cotton gin), John Kay (flying shuttle), Jonathan Hornblower (double-chambered steam engine), Charles Goodyear (rubber vulcanisation) and the Foudrinier brothers (mechanical papermaking) were but some of the many other inventors who ruined themselves in defending their patents. Whitney, as an industrial researcher, learned his lesson, and he launched a second, successful, innovative career as a manufacturer of firearms – without writing another patent. How wise Jonas Salk was when, understanding that academic scientists should seek esteem via reputation, not money, he dismissed the idea of patenting the polio vaccine as:- "like patenting the sun".

But the damage that patents impose is being increasingly

chronicled by scholars. In a startling piece of research, James Bessen and Michael Meurer of the law school of Boston University showed in their 2008 book *Patent Failure* that in 1999 (the last year they studied) the aggregate costs to the US of patent litigation was $12 billion but the aggregate profits to US companies of their patents was only $3 billion (these figures exclude chemical and pharmaceutical patents, see below.)

This is an extraordinary finding. It shows that, outside of chemical and pharmaceutical patents, patents were in aggregate costing America $9 billion in 1999 (and the figure has most certainly risen since.) Individual companies may have done well by their patents, but collectively American industry was suffering losses of $9 billion annually because of patents. Why?

There are two main reasons for this. First, overlap. Intellectual property is not the same as physical property. Consider a piece of land. It is discrete, and it is usually obvious who owns a piece of land and who may exploit it. But the different constituent parts of any new technology can be claimed by many people. Consider software. Any particular commercial advance will incorporate many individual technical advances, many of which will be patented. So, for example, David Martin, the CEO of a patent risk management firm, says that:- "if you're selling on-line, at the most recent count there are 4,319 patents you could be violating. If you also planned to advertise, receive payments for, or plan shipments of your

goods, you would need to be concerned with approximately 11,000" (Bessen & Meurer, 2008, 8-9). Clearly, any on-line seller today is potentially going to invite many lawsuits. He or she may possess a patent, but the other 4,318 patent holders will be able to stop him or her from exercising their patent because its exercise would violate their own interrelated patents. These different patents overlap in a way that pieces of land do not. So an on-line seller, even if he or she possesses some relevant patents, is nonetheless going to have to risk litigation because the costs of pre-screening all the potential patent infringements (at about $5,000 a patent) are prohibitive: it is best just to enter the market and be sued.

The other major problem is 'abstraction'. A piece of land is defined, and its owner is not going to be able suddenly to claim ownership of any one else's land. But technology is fluid. Consider as an example a handset. Imagine that a tiny little company patents a simple walkie-talkie system by which two people can communicate over short distances (loggers in a wood for example). Now imagine that a big company invents a dramatically superior technology, the mobile phone perhaps, by which millions can communicate simultaneously and globally. But this new technology will still need handsets, and though the new company might have invented its handsets afresh, the earlier company might be able to claim that its earlier patent on handsets had been violated by the new company, because inevitably there will have been some overlap (the shape for example) between

the earlier and later handsets. And the earlier company might in consequence claim billions in damages for violating a patent that actually played no direct role in the later invention. This because the earlier company could claim that its earlier patent was not just for a particular handset but could be 'abstracted' to cover all handsets, however independently invented.

In their 2008 book Bessen and Meurer show how, in the past, judges and courts were aware of the problem of 'abstraction', and how they were reluctant to reward patent holders for subsequent inventions that bore only a distant relationship to an earlier patent. But in 1982, in the US, a specialised patent court was created, the Court of Appeals for the Federal Circuit. Such specialised courts are unusual and dangerous, because they are themselves not subject to ready appeal, so they can generate precedents in an uncriticised way. This Federal Circuit Court, in a classic case of Public Choice Theory, has been very pro-patent-holder indeed, and it has seized upon abstraction to hugely increase the power of patent-holders and therefore to increase hugely the amount of patent litigation in the US and thus to also increase its own role, hugely seeking "to expand patent coverage to 'everything under the sun' – a phrase that is popular with the Federal Circuit" (Bessen and Meurer, 2008, 230). Following the creation of the Federal Circuit, the costs of patent litigation in the US have soared.

Chemicals and pharmaceuticals are two areas where the costs of litigation in the US ($4 billion in 1999) are still dwarfed by the profits companies make from them ($15 billion in 1999.) Why? One reason is clarity. A chemicals patent is almost like a deed on a piece of land: there is generally only one formula for each new chemical, and so there is only limited scope for conflict. Chemicals patents, therefore, appear to do only limited damage.

However, the only area where patents are actually justified is pharmaceuticals. Why? As I showed above in the example of the bakers, competition under the free market optimises R&D, so we need no government-gifted monopolies in innovation. But there can be no free market in pharmaceuticals because governments, rightly, impose vast regulatory costs on drugs. In 2000 it cost around $500 million to develop a new drug, and 70 per cent of those costs are dedicated to safety testing (DiMasi *et al*, 2003). Under those circumstances, it is only fair to researchers that they should enjoy a period of monopoly by which to recoup their initial investment because the costs of copying will be so much smaller than the costs of innovation. Indeed, once drugs' patents expire, prices drop to 37 per cent of their original level within two years (Grabowski and Vernon, 2000). Consequently, Bessen and Meurer (2008, 145) find that big pharmaceutical companies' profits from patents are around 79 per cent of their costs of R&D, which is very substantial indeed (chemicals patents were almost as profitable – unlike, as described above, the situation in all other industries where the costs of patent

litigation outweighed the profits from patents).

Oddly, though, it is hard to show that countries that strengthen their pharmaceutical patent laws generate more R&D in consequence (or vice versa; see Lerner 2002). There are probably two reasons for this. First, even within the pharmaceuticals industry, much of the profit from R&D comes from unpatented products (generic drugs for example are surprisingly profitable) and second the pharmaceutical industry spends more money on marketing than R&D, thus suggesting that even in the pharmaceuticals industry profits are generated less by 'objective' criteria than by 'subjective' ones.

In other areas of industry, strengthening patents seems not to stimulate R&D or innovation (Jaffe, 2000) which is not necessarily surprising, and nor does patent protection seem to promote endogenous private research within the developing world. Consider agriculture, which remains a major industry within the developing world. As we saw above, the economists Carl Pray and Keith Fuglie of the US Department of Agriculture found that private agricultural R&D will flourish within the developing world when the market is free. Changes in IPR, however, make little systematic impact:-

> There were substantial changes in IPR policy during this period [of the study] but they were not consistently associated related to changes in research intensity. For example, Malaysia and Thailand made improvements to their patent laws but

> had declining research intensity. India and Pakistan, which had very limited IPR changes, had the most rapid growth in research intensity.
>
> US Department of Agriculture,
> *Agricultural Economic Report No 805*, 2001

It is often said that patents protect small or lone inventors. Small or lone inventors are undoubtedly helped in their leverage of venture capital money by the possession of patents, but this raises the question: how important is small invention?

It is certainly true that during the 19th century, particularly in America, that small (i.e., people working in small companies) or lone inventors made a disproportionate contribution to innovation, and that their patents helped protect them (Khan, 2005). But today individual inventors account for only 12 per cent of patents and these tend to be in economically marginal areas (or in very mature areas, where significant single advances are rarely made; Bessen and Meurer, 2008, 169). This is because big companies have now routinised research:-

> Innovation itself is being reduced to routine. Technological progress is increasingly becoming the work of trained specialists who turn out what is required to make it work in predictable ways.
>
> J Schumpeter,
> *Capitalism, Socialism and Democracy* 1942, p 132

The economist of technology, Jacob Schmookler, agrees:-

> Invention was once … a nonroutine economic activity, though an economic activity nonetheless. Increasingly, it has become a full-time, continuing activity of business enterprise, with a routine of its own.
>
> J Schmookler,
> *Invention and Economic Growth* 1966, p 208

Moreover, the patents obtained by small firms are generally less valuable than those obtained by large ones (Bessen and Meurer, 2008, 174). Partly this is because small firms hold smaller patent portfolios. Most patents are not valuable because most ideas are not valuable: a survey in 2003 by Thomas Astebro of the University of Toronto of 1091 Canadian inventions revealed that only 75 reached the market, of which 45 lost money. Invention and patent-seeking is, therefore, a tournament, and the winners are those who can spread their bets most widely; small firms are thus disadavantaged.

Although it is supposed that lone inventors need patents to protect their ideas from being stolen by Big Industry, in practice lone inventors can generally approach companies safely:-

> Very few of those [big firm managers] could recall inventions submitted from individuals or very small firms that had been accepted, although one or two

> isolated cases were mentioned, but all said they were prepared to welcome promising cases. Most of the inventions submitted are relatively simple-minded, although some show genuine technical expertise or ingenuity, and the main reason for not taking them up are that the idea is old or that it is simply not a commercial proposition.
>
> Christopher Taylor and Aubrey Silberston
> *The Economic Impact of the Patent System* 1973, p322,
> Cambridge University Press

In reality, therefore, few lone inventors have much to offer big companies which, possessing teams of scientists and having routinised cutting-edge research, can generally beat the tiddlers. And, when lone inventors do pull ahead, they find protection in i) legally-binding confidentiality agreements which are easy to write and which have become standard practice, and ii) by the fear of:-

> the adverse publicity that tends to attach to a large company involved in a court action, especially where the opponent is an individual or a very small firm.
>
> C Taylor & A Silberston
> *The Economic Impact of the Patent System*
> 1973, p102

Such litigation is, of course, expensive but so too are patents, whose cost can be prohibitive to lone inventors. Frank Whittle for example, the lone inventor of the jet engine, could not

afford to maintain his patents and they lapsed (though their irrelevance was highlighted by the successful creation of the patentless Power Jet Company in 1936). Indeed, patents are so expensive as to preferentially empower rich companies over lone inventors. A 1996 OECD report showed that 60 per cent of all US patents are filed by fewer than 700 firms.

University researchers will benefit from patent rights, and the 1980 Bayh-Dole Act, which granted to US university researchers the IPR that they had themselves generated, has spun out a significant number of firms, but the profits those firms generate does not match the taxpayers' investment in university R&D (Kealey, 2008, 253).

Defenders of patents note that patents do allow science to be traded in the form of licences (so patents need not generate monopolies) and in 2000 the National Science Foundation reported that between 1980 and 1998 no fewer than 9,000 major US, European and Japanese firms entered into strategic technology alliances, sometimes leading to unusual newspaper headlines such as that of the 13th August 1997 in *The Times* of London which described the deal between Apple and Microsoft as the "Rivalry that Ended in Friendship". Meanwhile IBM invests so much in R&D that it has for the last 12 years been awarded more US patents (3,000 annually) than any other institution. And from its total of 40,000 patents IBM earns over $1 billion annually in license fees, thus accounting for over 2 per cent of all American licence fees.

But are such licence deals really optimal? Japanese patents are weaker than US or European patents, and they provide inventors with less protection with the result that, under the protection of confidentiality, Japanese inventors enter more readily into technology-sharing agreements with companies, thus speeding the dissemination of inventions within Japan and enhancing its productivity - which has in turn helped boost Japan's vast private investment in research.

Addressing some of the problems of patents

In their book *Against Intellectual Monopoly* (which is freely available on the web, of course) two American economists Michele Boldrin (Washington University at St Louis) and David Levine (UCLA) propose the total abolition of patents (except in the case of pharamaceuticals). That might be too radical a solution to the problem of patents, but in their 2008 book *Patent Failure* Bessen and Meurer revive the old idea of compulsory licensing. It is usual in the world of copyright for national governments to allow compulsory licencing, whereby someone has the right to, say, play a piece of copyright music on demand, subject to the payment of a fee, the size of which may be determined by convention or by arbitration. The international patent treaties provide governments with the same powers over patents, and Bessen and Meurer argue convincingly that such powers, if exercised, could prevent much wasteful litigation.

Certainly, compulsory licensing has emerged strongly within pharmaceuticals. The 1986-93 Uruguay Round of the World Trade Organisation (WTO) established such strong intellectual property rights (which preferentially advantage western countries, for obvious reasons) that, as the Economics Nobel Laureate Joseph Stiglitz protested in his 2002 book *Globalization*, "the result was that some of the poorest countries in the world were actually made worse off". In particular, the Uruguay Round prohibited the Third World from manufacturing cheap copies of drugs, and the subsequent rise in deaths ("Millions of people are dying and will die because trade is privileged over human beings" said James Orbinski of Médecins Sans Frontières) proved such a scandal that, in its Doha Development Agenda of 2001, the WTO instructed the TRIPs council to allow the manufacture certain drugs, cheaply, under compulsory licences.

Within the developed west, patent pools would provide a separate solution to the problem of endless litigation, and there are good arguments for anti-trust laws (if they inhibit the creation of pools) to be sufficiently relaxed to encourage them.

Conclusion

People take out patents to inhibit the competition, and as Karl Marx said, capitalists seek to close markets, not open them. As Adam Smith said:- "Men of the same trade

seldom meet together … but the conversation turns into a conspiracy against the public". These two thinkers would have understood the contemporary scepticism about patents, as would campaigners for social justice: patents are a weapon the rich can aim at the poor because, inevitably, the rich do more science than the poor.

Too many market thinkers, in their respect for property rights, are reluctant to acknowledge the difference between rights in tangible objects and those in knowledge. So, for example, when Paul Wolfowitz was at the Defence Department, his web site boasted that when he had been Ambassador to Indonesia between 1986 and 1989 he had been "a tough negotiator on behalf of American intellectual property owners". But even Wolfowitz knows what impact such American intellectual property ownership had on Indonesian economic development, and his World Bank site stated simply that during his time in Indonesia:- " … he was known for reaching out to all elements of society and for his advocacy of reform and political openness".

Individual patent holders can indeed do very well by their patents, so they will create a powerful pro-patent lobby in ways that Mancur Olson (1965) would have understood. It behoves the rest of us to resist the encroachments of these technological plutocrats.

References

Allen, Thomas *et al* (1983) Transferring Technology to the Small Manufacturing Firm, *Research Policy* 12: 199-211.

Astrebo, Thomas (2003) The Return to Independent Invention: Evidence of Unrealistic Optimism, Risk Seeking or Skewness Loving?, *Economic Journal* 113, 226-239.

Baumol, William (2002) *The Free-Market Innovation Machine,* Princeton University Press.

Bugbee, Bruce (1967) *The Genesis of American Patent and Copyright Law,* Public Affairs Press.

Busom, Isabel (2000) An Empirical Evaluation of the Effects of R&D Subsidies, *Economics of Innovation and New Technology* 9: 111-148.

Cohen W, Nelson R, Walsh JP (2000) Protecting Their Intellectual Assets: Appropriablity Conditions and Why US Manufacturing Firms Patent (or Not), NBER Working Paper No. 7552.

DiMasi JA, Hansen RW, Grabowski HG (2003) The Price of Innovation: New Estimates of Drug Development Costs, *Journal of Health Economics* 22, 151-185.

Garfield, Simon (2001) *Mauve,* WW Norton & Co.

Grabowski H and Vernon J 2000 Effective Patent Life in Pharmaceuticals, *International Journal of Technology Management* 19, 98-120.

von Hippel, Eric, (1998) The Economics of Product Development by Users, *Management Science* 44: 629-644; von Hippel, Eric (1988) *The Sources of Innovation,* Oxford University Press.

Jaffe AB (2000) The US Patent System in Transition: Policy Innovation and the Innovation Process, *Resarch Policy* 29, 531-557.

Johns, Adrian (2009) *Piracy: The Intellectual Property Wars from Guttenberg to Gates*, University of Chicago Press.

Kealey, Terence (2008) *Sex, Science and Profits,* William Heinemann Ltd.

Khan, B. Zorina, (2005) *The Democratisation of Invention During Early Industrialisation: Evidence from the United States 1790-1920*, Cambridge University Press.

Lerner, J (2002) 150 Years of Patent Protection, *American Economic Association Papers and Proceedings* 92, 221-225.

Maddison, Angus (2003) *The World Economy*, OECD.

Olson, Mancur (1965) *The Logic of Collective Action: Public Goods and the Theory of Groups,* Harvard University Press.

Schiff, Eric (1971) *Industrialisation Without National Patents*, Princeton University Press.

Sokoloff, Kenneth (1988) Inventive Activity in Early Industrial America *Journal of Economic History* 48: 813-50

Schumpeter, Joseph (1941) *Capitalism, Socialism, and Democracy,* Allen & Unwin London.

UK Committee of Inquiry, M A L Banks (1970) *The British Patent System* [1970-71 Cmd 4407].

Galambos, Louis & Sturchio, Jeffrey (1997) The Transformation of the Pharmaceutical Industry in the 20th Century in: J Krige & D Pestre (eds) *Science in the 20th Century,* Harwood Academic Publishers, Paris, France.

Saxenian Annalee (1994) *Regional Advantage,* Harvard University Press p 33.