Innovation and the Patent Attorney

STUART MACDONALD & BERNARD LEFANG

ABSTRACT *Patents, as one of the few quantifiable outputs of research, are increasingly being used as an indicator of the less quantifiable—innovation, and the competitiveness that is assumed to spring from innovation—on the grounds that these, too, are outputs of research. The part that patents actually play in innovation has become confused with their representational role. This article steps back from the confusion of what patents do and what patents indicate being done, to examine the nexus itself. In good patent tradition, this can be achieved by means of an indicator—the patent attorney. Increased involvement of the patent attorney in innovation would seem to be a reasonable measure of the intensification of the patent-innovation nexus. On the implications of this intensification, the article merely speculates, though with some consternation. How can the logic of the patent system sustain the argument that information is protected so that it can be disclosed when increased incentive to protect is in conflict with the incentive to disclose? What role is there for creativity and serendipity in an innovation process that is legalistic and litigious? It is even worth considering what value patents retain as indicators when growing acceptance of their association with innovation gives them a value in their own right. Indeed, this value may sometimes be so great that innovation itself is rendered irrelevant.*

Keywords: indicator, information, innovation, patent attorney, patents.

Enter the Law

The role of the patent attorney in innovation has traditionally been confined to patent matters, most obviously assisting clients in their applications for patent protection. But this role appears to have been expanding of late, in large part, it would seem, because the role of the patent itself has assumed a greater importance in innovation. For example, a recent proposal presented to the US House of Representatives would give the Commissioner of Patents and Trademarks responsibility for regulating services offering assistance in the development of inventions, and would allow patent attorneys a privileged position in the provision of these services.[1] Patent attorneys have not been reticent to advertise the marketing services they are now offering as an integral part of patent protection.

> I'll be your quarterback and help you:
>
> - conduct a patent search
> - build your business and manufacturing team
> - sell your product in a test market
> - file your patent.
>
> Want help carrying your product to market?[2]

0810-9028/97/030329-15

In fact, many patent attorneys now seem to be in the business of invention promotion. That activity—seeking to interest firms in developing and manufacturing inventions, often those of independent inventors—has long been the subject of much criticism in the United States and more recently in the UK,[3] perhaps with some justification.

> Unscrupulous invention development organizations attract inventors with tales of huge royalties, take their money, and provide little, if any, real service. Indeed, they often do real harm to the interests of those they are ostensibly trying to help.... [This] tarnishes the reputation of the many legitimate organizations dedicated to assisting inventors and undermines the integrity of the system for the protection and therefore encouragement of inventions.[4]

Not all firms in the invention promotion business have been noted for their skills in interesting companies in the inventions of their clients.[5] But are patent attorneys likely to fare any better? And why is it that patent attorneys have entered a business in which they have previously had little presence, and for which their experience, skills and qualifications would seem to be less than appropriate? In itself, the issue is not of major importance—except for firms already offering these services and for the inventors who require them—but it does serve as an indication, and a very pointed one, of a more pervasive change that is occurring in attitudes to innovation, a change that has major implications for the creation of innovation and for all that depends on this happening.

The New Scope of Patents

It has long been the tradition of the patent system that only devices are patentable, not ideas. They must be novel, and useful. The arcane nature of patent classification, which has little relation either to scientific and engineering disciplines or to industry sectors, bears witness to this utilitarianism. It has become increasingly difficult to fit much modern invention within these quaint categories, and so to argue that the patent system is stimulating the innovation that a modern economy requires. Consequently, there has been pressure to extend the scope of the patent system and, indeed, other forms of intellectual property protection. The patenting of genetic material is one example; the extension of the patent system to computer software is another. Copyright, bestowing property rights for the better part of a century, had previously been the device used to protect that most transient of inventions. The Supreme Court in the US has recently ruled that though the algorithms of computer programs are not themselves patentable, a process which incorporates an algorithm in a computer program is. As a computer specifically built round an algorithm is patentable, so is any computer which can use the same algorithm, and so is the software which allows the computer to perform the algorithm—a logical, if legalistic, progression.

> ... attorneys began to achieve software patents by expressing a software concept as hardware. By asking inventors to design hardware equivalents to their software inventions, the patent attorneys could patent these impractical electrical clones and, via embodiment equivalence, protect any software implementation utilizing the same concept.[6]

One consequence is that any of the hundreds of techniques used to produce a new computer program may now have already been patented. This makes life somewhat difficult for software designers, somewhat busy for patent attorneys, and does not necessarily yield more innovation.

> It is thus now necessary to involve patent attorneys at every phase of program development.... Software patents will put an end to software entrepreneurs.[7]
>
> Software patents are failing to achieve the Constitutional mandate of promoting innovation and indeed are having a chilling effect on innovation activity in our [software] industry.[8]

The establishment of the US Court of Appeals of the Federal Circuit (CAFC) in 1982 was in large part a response to the growing complexity of some of the new areas into which patents were entering. So complex were the issues that a specialist body was considered essential. Its impact has been to strengthen the patent system, an impact which was not entirely unforeseen, nor entirely unwanted. Between 1982 and 1987, the CAFC upheld 89% of district court decisions that patents were valid, compared with between 30% and 40% previously.[9] Penalties for infringement have become very severe: Eastman Kodak recently paid Polaroid over $900 million in damages, and Procter and Gamble is reported to have been paid $125 million for infringement of its dual-texture biscuit patent.

> Defendants that have been judged guilty of 'wilful and wanton' infringement can be assessed treble damages, interest that accrues while they appeal, and the plaintiff's legal fees. Worse, judges are ordering companies found guilty of infringing to stop selling copycat products immediately, rather than allowing them to continue business as usual until completion of the appeal.[10]

The consequence has been to increase the value of an American patent in as much as the patent is now very much easier to defend, or, in the hands of a competitor, very much harder to challenge. Inevitably, change in the law increasing the scope of patent protection and the value of a patent has brought patent attorneys into greater prominence. In itself, this is of little consequence—except for patent attorneys. But the patent system is a balance between conflicting interests and the new prominence of the patent attorney seems to indicate that a shift has taken place in this balance. This is something which may have very serious consequences for innovation.

Invention to Innovation—a Linear Model or a Maze Model?

An invention is a discovery: an innovation is a product or service that is new to the market, or simply new to the adopter.[11] Of the total resources required for innovation, only a small proportion comes from invention; the majority come from design, production, marketing, and so on. Nor does every invention contribute to innovation: most inventions make no input at all. For example, of the 1600 inventions submitted to the Wisconsin Alumni Research Foundation, only 65 were licensed to industry and only 36 generated sufficient revenue to cover the Foundation's costs.[12] Another estimate is that just one in a hundred patents produce any income whatsoever.[13] Worse still, it is always uncertain which ones will and which ones will not produce income. Even innovations which eventually prove to be enormously successful in commercial terms can be poisoned chalices for their developers, as EMI discovered with its CAT scanner, de Havilland with the Comet, Bowmar with the pocket calculator, and RC Cola with such novel products as cola in a can and diet cola.[14]

This failure to achieve the ultimate goal of successful innovation is often blamed upon what is seen as a rocky road from invention to innovation. Inventors are proffered advice aplenty—much of it centred on patents—on how they might avoid the potholes and reach their destination. An alternative model avoids the notion of a journey from invention to innovation; it sees no direct route with a beginning and an end. A linear

model is replaced by a maze model with a confusion of interconnections among all the factors that contribute to innovation.[15] There is no clear and obvious route from invention to innovation; the journey may start anywhere in the system and may lead anywhere, perhaps to invention more than once, before innovation is reached—that is, if innovation is ever reached at all. Innovation remains the goal, but getting there is the real challenge: innovation is not simply the last stop on the line.

The Patent—Invention or Innovation?

In the midst of both the linear model and the maze model is the patent system, though it is seen as a convenient stretch of fast highway in the former and as a further complication in the latter. The existence of a patent system is explained less by perceptions of the route to innovation than by the product of invention being information. A fundamental characteristic of that peculiar economic good is that it can be appropriated by others while still being retained by the inventor. As long as his discovery can be seized by others, the argument runs, the inventor has little incentive to invent, and so society is deprived of whatever contribution to innovation more invention might have made. Clearly it is in society's interest to devise a means of overcoming this *impasse*. The solution is an intellectual property system consisting of copyright, trade marks and patents and, peripherally, trade secrets. The patent is the core of this system. Its function is to deter the appropriation by others of the information of invention by bestowing on the inventor property rights to this information. But society does not benefit from invention itself, rather from the innovation to which invention may contribute. It is this innovation that society wants in return for the property rights it has conferred. Herein lies a problem: society may want innovation from its patent system very much indeed, but the patent system is really concerned only with invention.[16]

This desperate desire for innovation has produced two arguments in justification of the patent system. Though they are not incompatible, they are seldom presented together.[17] Both are rooted in the supposition that invention would not take place if it could be purloined by anyone so inclined. The first argument emphasises development: the patent system gives an incentive to invent because it allows the inventor to reap a reward from his invention, either through developing it himself or by selling it to others for them to develop. The second argument is less contingent on development and emphasises information: it is that a bargain has been struck between the inventor and society by which society grants property rights, with which the inventor may do what he will, in return for giving society the information of his invention.[18] In the first argument, society allows the inventor to make his information public: in the second, society demands that he make his information public. The first argument supposes patent information leading directly to innovation and that innovation is society's reward: this is compatible with a linear model of innovation. The second fits better with a maze model of innovation in that it sees patent information adding to a social store of information in which information for innovation may be found, and—with the owner's consent—used. In this case, information is society's reward.

Any strengthening of the patent system makes the distinction between the two perspectives rather important. The balance is tilted in favour of seeing the benefit to society not in terms of making information available for innovation, but in terms of innovation itself. This shift is evident in the growing tendency of the CAFC to regard the commercial success of innovations as a major determining factor in the granting and upholding of patents.[19] Thus is the patent system extended from mere invention to

encompass the host of factors—production, distribution systems, service networks, advertising, marketing and whatever—which contribute to the success of innovation.

> ... an overemphasis on successful innovation, coupled with reduced attention to the presence or absence of a true invention, reinforces only one of the dual policy goals of the patent system: providing incentives to inventors. It ignores the goal of encouraging inventors to disclose technical information.[20]

With such an intimate association between the patent and innovation, there is no incentive to disseminate the information of invention further than is necessary to attract interest in development. And, if the inventor is to be the developer, not even that far. There is less patience with the argument that it is incumbent on the inventor, and the patent system, to broadcast the information of the invention as widely as possible. The public good arguments traditionally presented to support the dissemination of information by patent offices begin to sound increasingly out of tune with the times.

> Each patent specification is a detailed disclosure of the invention and it is this aspect of course which is particularly valuable as a rich source of technical information.[21]

In academic studies of innovation, linear models have long since been dismissed as unrealistic and unhelpful, yet they endure. In part, this is because of an essential simplicity, which is attractive in any model, but it is also explained by the attraction of a linear model to specific interest groups. It is not wholly repugnant to scientists, for example, to believe that, upon their efforts in basic science, all that occurs in applied science, development and production depends. Nor do the institutions in which such endeavour takes place rush to oppose the notion of linearity; after all, there is no other argument to hand which so readily justifies incurring large and immediate costs for distant and uncertain benefits. Thus it is that universities have shown little restraint in the race to take out patents, regarding them as both performance indicators of the progress they are making along the road to innovation, and as a means of generating revenue. By 1986, universities held almost 2% of US non-government patents. Despite some examples of outstandingly profitable university patents—Stanford will apparently make $87 million from the licensing of one biotechnology patent[22]—it would seem that, overall, even the direct costs of patenting exceed the profits.[23] In the longer term, the costs of constraining university research to fit the requirements of the patent system (and increasingly the patent attorney) are likely to be much greater and are to be measured in terms of the damage done to innovation by the neglect of unpatentable research and restrictions on information flow. From the perspective of the British Technology Group, which specialises in exploiting university patents, this is not a problem.

> Our biggest competitors are not other agencies like ours. They are researchers talking to industry or giving their ideas away at conferences and so on.[24]

It would not be unfair to include within the group which is more comfortable with a linear model than a maze model, with emphasis on protected development rather than the dissemination of information, those dependent upon the patent system itself. It is much easier to justify their function on the grounds that invention makes a seminal and direct contribution to innovation than on the grounds that it makes only one contribution among many, and that indirect and uncertain. And thus it is that patent attorneys are among those who have a natural affinity for a linear model. Their training and experience generally deny any other perspective in as much as, in common with scientists, university administrators and patent office officials, they have never stumbled through the maze trying to find their way to innovation. But a linear model allows the patent attorney to take on the role of guardian or nursemaid to the invention, seeing it

through to the maturity of innovation. When the patent system concerns itself with not just invention, but also innovation, so too must the patent attorney.

National Security, Competitiveness and the Patent Attorney

The patent attorney has traditionally had little to do with innovation. The qualifications, skills and experience of the patent attorney are in the law, and specifically the law relating to intellectual property in general and patents in particular. The talents most valued in bringing about innovation are wholeheartedly commercial; a vast range of them to be sure, but not a range in which the law has had any prominent place. All this may be changing, but not because the patent attorney has any more to contribute to innovation. It may be changing because of new expectations that the patent system can bring about innovation. In consequence, a new link is being forged between innovation and the patent attorney.

While the function of the law is to serve the public interest, the function of the individual lawyer is to serve his client. A maze model of the role of the patent system in innovation leaves little for the patent attorney to do after the granting of a patent—both the inventor and society benefit from the wide dissemination of the information of invention. But a linear model has no place for such dissemination and values the patent attorney's ability to prevent it.

> A company's patent lawyers can protect the company's proprietary position without giving away too much in the application process.[25]

Indeed, even the *Harvard Business Review*, which might have been expected to adopt a managerial approach to innovation, can consider the prospects of an innovation entirely in terms of the strength of the patent and the quality of the patent attorney.[26] In such a mechanistic approach to innovation, the manager is replaced by the patent attorney as the central figure. This is a radical translation wrought by changes more fundamental than a simple strengthening of the patent system, changes in attitudes to the role of information in innovation.

Among the factors which have encouraged patent attorneys to adopt a new responsibility for innovation is a very fundamental change in attitude towards national security, perhaps most evident in the US. Long before the demise of communism in the Soviet Union and Eastern Europe, it was plain that national security was not simply a matter of military might, but also of technological strength. The fall of the Berlin Wall simply made this incontestable. Thus, innovation, the source of technological strength and hence competitiveness, was seen to be crucial to national security, and—following a linear model—so was the patent system.

> When intellectual property rights are protected, *innovators* are able to recover the costs incurred in research, product development and market development. This cost recovery ... is essential for stimulating the future research and development that is necessary to maintain America's competitive edge.[27] [emphasis added]

There has, of course, always been a connection between the ability of innovation to produce wealth and the capacity of a nation to defend itself. This is most obvious when innovation is in military technology. But computer and telecommunications technology have blurred the distinction between what is military technology and what is civilian. Moreover, the pace of civilian innovation has generally been much more furious than that of military. By the early 1980s, it had come to be appreciated that it was as important to keep civilian technology from the enemy as it was military, and appreciated that the key to this technology was information—know how—rather than equipment. A

patent system which sought to disseminate information as widely as possible was singularly inappropriate.

> ... control of design and manufacturing know how is absolutely vital for the maintenance of US technological superiority. Compared to this, all other considerations are secondary.[28]

During the same period, the United States became increasingly aware that its technological supremacy was being threatened by the Japanese, and even by the Europeans. Laws intended to prevent the leakage of military technology to the Communist Bloc were quite naturally applied to trying to prevent civilian technology leaking to Japan. The Toshiba incident of 1987, when Congressmen smashed Toshiba products with sledgehammers on Capitol Hill, and huge commercial penalties were unilaterally inflicted on the Japanese company for its complicity with the Soviet Union, is just the most graphic example of the enthusiasm with which US law was applied extraterritorially for US commercial advantage. But the nature of information dictated that controls on its export would never be effective. It had to be controlled within the US, and within companies. National security depended upon it, because competitiveness and innovation depended upon it.

> You have got to question about the validity of the firm you are dealing with, especially a foreign firm. Go to the FBI, ask questions. The FBI has recently sought to publicize their efforts in this problem in our particular area by putting up billboards similar to the World War II type of thing about the walls having ears.[29]

> Corporate executives and leaders of the business community must not only be understanding of the need for compliance and be supportive of the government's export control efforts, they must translate this state of mind into effective action by their company staff, managers and supervisors.[30]

The notion that it is in the inventor's interest to retain information, that the benefits of innovation come from keeping information within a country or a company, is entirely in keeping with an approach to the patent system which sees its function as securing information, and certainly not disseminating it. Innovative companies are imagined to be those which keep their information to themselves.

> The future trend is to limit the amount of people with security clearance and restrict classified information on a 'need to know' basis. If there is no clear reason for an individual to know a secret, access to the secret will not be allowed.[31]

Despite all the evidence that innovation requires a wide range of information from a wide range of sources, many of them outside the innovating organisation,[32] and that much of this information is received in exchange for information given, there has long been a tendency to equate loss of information with diminished ability to innovate. Of course, information cannot be lost in quite the same way that other goods can be lost; it may be transferred elsewhere, but always remains whence it came. It is quite wrong to assume that lost information easily finds its way to where it will be utilised for competitive advantage. In reality, information transfer is easy, but information transactions—finding and acquiring the right information—are hard. Put another way, it is extremely easy to lose information, and extremely difficult to find it. Even codified information is hard to find and acquire, and the information of which innovation is composed is rarely neatly codified. This means that successful transactions for the information required for innovation tend to involve exchange of information, information leaving the organisation in return for other information entering.[33] Thus, firms in an industry are interdependent; they progress together.

This view of innovation is completely at odds with that which is often perceived from

Table 1. Inventions that would not have been developed in the absence of patent protection (%)

Pharmaceuticals	60
Chemicals	38
Petroleum	25
Machinery	17
Fabricated metal products	12
Electrical equipment	11
Primary metals	1
Instruments	1
Office equipment	0
Motor vehicles	0
Rubber	0
Textiles	0

Source: Edwin Mansfield, 'Patents and innovation: an empirical study', *Management Science*, 32, 2, 1986, pp. 173–181.

the patent system. From the patent perspective, it seems that a race is in place with the winning competitor taking all.[34] From this perspective, it makes sense for the organisation to guard all its information lest a competitor use it to innovate first. This is totally in keeping with legal advice on organisational patenting. Moreover, it is totally in tune with a wide range of academic thinking and organisational practice in innovation. For example, economists regard the leakage of R&D information as an obvious loss to the firm.[35] Managers see the loss of key employees and the information they carry with them to competitors as clearly damaging to the firm's innovative capacity. Yet, in terms of the capacity of such loss to facilitate information transactions, to bring other information into the firm, there may in fact be benefit for innovation. In Japan, where weakness in invention does not seem to have impaired strength in innovation, the patent system is still supposed to serve the larger national goal of encouraging innovation through the rapid diffusion of information, its function being to 'share technology, not protect it'.[36]

Pressures on the Patent System

Some industries are very much more reliant on the patent system than others. Basically this is because invention in these industries is highly codifiable.[37] The difficulties normally associated with information transactions are easily overcome, allowing information to be acquired and used by competitors. Put another way, the precision of a chemical or pharmaceutical patent specification makes the patent particularly easy to defend and thus enhances the value of the intellectual property.[38] A chemical formula is an excellent example, and so it is that the chemical, and particularly the pharmaceutical industries, are heavy users of the patent system and extremely dependent on it. Table 1 gives some idea of the extent of this dependence and of how this differs from dependence in other industries. As Taylor and Silberston concluded more than two decades ago, the 'pharmaceutical industry stands alone in the extent of its involvement with the patent system'.[39] The pharmaceutical industry has done much since then to ensure that the patent system meets its own requirements, basically the requirements of large companies,

operating with highly codified information on a route to innovation made linear by government regulation.

While the patent system may serve these industries well because of the nature of their invention, it does not necessarily serve other industries, those with less codified invention, quite as well. Some concession is often made to these differences in the extension of patent term afforded to pharmaceutical companies to allow for the years that governments insist they spend testing their innovations, but this comes nowhere near satisfying their declared requirements. Business strategy in these industries is thoroughly focused on making the whole patent system as powerful as possible. Certainly the pharmaceutical industry is quite unashamed in its lobbying to strengthen the patent system on the grounds that a strong patent system is essential not only for pharmaceutical innovation but for all innovation.[40]

In fact, some industries seem to have thrived in just the opposite patent climate, the computer and electronic industries being the most outstanding examples.

> A weak patent policy did not slow things down in the development of the integrated circuit and microprocessor. In fact, it sped things up. The legal environment of the 1970s allowed Fairchild, Intel and others to get their start, carrying the lesson that strong patents for every industry are not always good.[41]

In these industries, invention is not easily codified and the pace of innovation far outstripped the leisurely plod of the patent process. All this has changed with the new prominence of the patent system. TI, for instance, once liberal in its cross-licensing arrangements with competitors, has become particularly litigious. Its most profitable product line is now patent royalties.

> With cases lasting four years plus and running anywhere from $2 million to $10 million, computer companies are spending as much time in the courts as they are in the laboratories.[42]

The likely impact of this behaviour on innovation is obvious. As Lamberton has recently observed in the light of US enthusiasm for extending intellectual property rights, 'much of the benefits of intellectual property rights go to those best able to cope with or live off the legal system'.[43] It has even been suggested that:

> ...a very small group of large high technology firms and trade associations in the telecommunications, computer and pharmaceutical industries was essentially responsible for the creation of the CAFC. The group believed that a court devoted to patent cases would better represent its interests.[44]

Patents and Corporate Strategy

It was once a regular complaint of policy makers that most companies in most industries had no technology strategy, much less a patent strategy, and that technology played little or no part in their overall corporate strategy. For some companies, however, corporate strategy has long afforded patents a central place. Bowker describes the elaborate preparations of Schlumberger for the legal defence of its oil exploration patents in the 1930s in terms which show scant regard for the role of the patent system in the dissemination of information for innovation.

> Schlumberger needed to publish to gain respectability and to establish their own version of the history of prospecting. Accordingly, scientific articles and textbook references would be as far as possible inscribed within the account that the patents

> gave of their technical objects or would be written by others with knowledge of only the public face of the company.[45]

The new patent regime in the United States, which has dramatically increased commercial pressure to patent, has made patent policy central to corporate strategy in many more companies. Patents are now much more likely to be upheld, and because the cost of infringement has come to be based not on lost royalty fees, but on lost profits—trebled when damage is deemed willful—all corporate strategy must take patents very seriously indeed. The most notorious example of the strategic impact of another company's patent has been the suit between Eastman Kodak and Polaroid.

> A district court put Kodak out of the instant camera business in one day. That's something chief executives understand.[46]

'Land-mine patents'—patents granted long after a technology has become widely adopted[47]—can have a devastating effect on whole industries. In 1990, Gilbert Hyatt obtained such a patent on the microprocessor after a 20-year struggle, something of an upset for a mature industry.[48] Patent litigation increased markedly during the 1980s, apparently discouraging much of the venture capital which had previously funded new firms in Silicon Valley. Internationally, the change is evident in patents no longer being the esoteric concern of the World Intellectual Property Organization, but central to the interests of the General Agreement on Tariffs and Trade.[49]

Information Costs of the New System

A stronger patent system, even if it does generate more innovation, must also increase the cost of that innovation. With greater stringency, a greater proportion of the costs of innovation is the cost of the patent system itself. Most obviously, the cost of avoiding infringement rises.

> Companies should not work on a new process or concept without reference to existing patent literature. Relevant patents may still be in force which, if ignored, could prevent the manufacture and marketing of the new concept under consideration.[50]

The information the patent system has accumulated is no longer seen as contributing to innovation, but as an obstacle to innovation. It becomes the responsibility of the patent attorney to help his clients avoid such obstacles.

> Corporate patent attorneys have started scrutinizing their companies' patent portfolios and have become more reluctant to give R&D managers the go-ahead on a new idea or business for fear of duplicating a patented product.[51]

Any lengthening of the patent term—a perpetual demand of the pharmaceutical industry—not only increases the search costs of other firms, but also the risk of infringement.

> ... inventions build on each other, and a long patent grant may have deleterious effects on the incentives of other firms to engage in related research, for fear that they will be at the mercy of the original patentee.[52]

The information in a patent specification is codified. Transactions and transfer are easy, but much more information is required before innovation can result. This is why licensing agreements nearly always involve the transfer of know how, often in a human container. There is growing pressure these days to increase the codification of information. This comes largely from dependence on information technology, a technology

which can store, process and transfer codified information with extraordinary efficiency, but which copes poorly with the uncodified. There are obvious advantages in codifying as much information as possible. The problems this entails are beyond the concerns of this article, but the attractions of a patent system which claims to be able to codify the information essential for innovation are obviously enhanced. In most industries, though, codified information makes little contribution to innovation. In the same way that an organisational information system which cannot cope with irregular, tacit, informal information is likely to deprive the organisation of the very information it requires for innovation,[53] so a patent system which copes splendidly with only codified information may deprive society of the other information it requires for innovation.

This neglect of the other information required for innovation is becoming evident in the use to which patent statistics are being put. Essentially these show how many patents have been taken out year by year. For decades, academics and policy makers have been making what they can of these figures for they provide a quantification of invention unavailable elsewhere. Patent offices were often the main opponents to even this modest use of their statistics, arguing that they were collected for internal purposes and that the marked differences in the propensity of countries and industries and companies to patent distorted anything that analysis of the statistics might reveal.[54] Always, though, the primary objection to the serious use of patent statistics was that, at best, they measured invention and not what was really of much more importance—innovation. Much patenting has nothing whatsoever to do with the prospect of innovation.

> Every day people spend thousands of dollars on cars, jewellery, and other 'status symbols', so there is no reason why a patent, which shares a new idea with us all, ought not to be acquired for its personal value, too.[55]

The resistance of patent offices to the use of their statistics to reveal more than the incidence of invention seems to have softened, perhaps in response to its growing acceptance in policy circles. Policy makers have long sought a neat and convenient indicator of innovative performance. The change in attitude may also have something to do with the convenience with which patent statistics can be obtained and manipulated now that so many patent offices are storing their figures electronically. It may also be relevant that many national patent offices are becoming commercial organisations, much concerned with demonstrating how relevant their services are—to innovation, of course, rather than merely to invention. Patent statistics are now widely accepted as a valid indicator of the technological strength of nations, industries, and even individual companies.[56] Thus, the technological decline and reduced competitiveness of the US can be conveniently measured in terms of the proportion of US patents taken out by foreigners. Much is made, for example, of the revelation that, by 1985, Japanese companies took out more patents in the US than American companies.[57]

> The patent data clearly show a major tilting of the technological balance away from the United States and toward Japan. This appears to be as much a [sic] consequence of declining or stagnating American technological output as of growing Japanese [sic] capabilities.[58]

The link between innovation and patents is being confirmed by the use to which patent statistics are being put. Yet, even at the national level, patent systems fulfil different purposes: the Japanese goal of using the system to promote the rapid spread of technological know-how among competitors in a manner that avoids litigation ...[59] can hardly be said to be the goal of the US system. Under the Italian system, and many other national systems, there is not even a test for novelty.[60] Yet, at the industry and company level, vast differences in propensity to patent are now dismissed with impunity.[61]

But academic debate over the validity of patents as an indicator rather misses the point: what has been accepted in practice is not that patents merely indicate innovation, but that patents actually cause innovation, even that patents are innovation. Because patent counts are now taken so seriously, even as a benchmark of competitiveness, there is pressure on employees in many organisations to create the patents to be counted, and—as in Japanese companies—employees may be offered incentives to patent as much as possible.[62] Share price rises on news that a patent has been granted, and falls on news that it has been challenged. Apart from giving a new meaning to the notion of patent race, this emphasis on the patentable must be at the expense of the unpatentable. There is much research whose output cannot be patented and which is likely to be increasingly ignored because it is ignored in patent counts. In as much as this information makes an essential contribution to innovation, the incidence of innovation may actually decline as patenting itself increases.

Conclusion

This article has taken an unusual approach to its subject in that it has used an indicator to examine a subject which is conventionally used as an indicator itself. It does this because the patent as an indicator of innovation seems to have been compromised. A whole range of factors is responsible, but fundamental to them all is a stronger patent regime, certainly in the United States. This has altered attitudes towards patents, and thus towards innovation. Notions of the route to innovation being more like a maze than a highway, and of the function of the patent system being as much to disseminate information as to protect it, have been obscured by a new and growing emphasis on the role of patents in innovation. No longer is the patent simply an indicator of invention, or even of innovation; the patent is regarded as almost the equivalent of innovation. Changes in the role of the patent attorney have been employed to trace this transition.

The patent system has always seemed to play a greater part in innovation than it really does. This is because its codified neatness provides welcome assurance in the real world of messy and uncertain innovation. The new world of patent-orientated innovation offers a more dangerous illusion—that all innovation can be rendered neat. This new order provides new opportunities for the patent attorney. There are also likely to be distinct advantages for those industries, those companies, those academics, those administrators and those policy makers who are comfortable with the idea of a neat and ordered world. But for innovation as a whole, the new order brings only problems. Innovation is not usually a linear process. Anything which helps affirm this error is a deterrent to understanding how innovation really does occur, and therefore to innovation itself. Innovation is not usually promoted by restricting the flow of information. It feeds off information. That patent attorneys, experts in claiming and maintaining property rights over information and in restricting its flow, now advertise themselves as able to turn invention into innovation is a useful indication of just what, and how much, change has taken place.

> Patent protection is crucial to keep your idea *yours*. However, our practice is not limited to patents. Our trademark, copyright, and marketing services make it possible for you to protect *all* of your ideas and expose them to manufacturers and/or distributors *all in one place*![63] [original emphasis]

Acknowledgements

Research for this article was funded in part by a grant from the Economic and Social

Research Council in the UK for the project *Protection or Dissemination? The Contribution of the Patent System to Innovation in SMEs* (grant L325253021). Assistance was also received from the Invention Submission Corporation in Pittsburgh. The authors are grateful to Peter Drahos and Gerry Hanlon for their comments on drafts. Responsibility for the article's deficiencies rests with the authors alone.

Notes and References

1. A Bill to Amend Part I of Title 35, *United States Code, to Provide for the Protection of Inventors Contracting for Invention Development Services*, House of Representatives 2419, 28 September 1995.
2. Advertisement by patent attorney, *Inventors' Digest*, November-December 1995, p. 45.
3. For example, *Watchdog programme*, broadcast BBC 1, 12 December 1994, BBC transcript 1 LFE E165S; 'ISC—their side of the story', *Inventors World*, 3, 1995, pp. 38–41.
4. Michael Kirk, 'Testimony of Deputy Commissioner', *Patent & Trademark Office Society*, October 1994, pp. 731–740.
5. Gerald Udell, 'Unsolicited product ideas—a new evaluation program', *Research Management*, 19, 4, 1976, pp. 14–17.
6. Steve Gibson, 'US patent office's softening opens floodgates for lawsuits', *Infoworld*, 14, 35, 1992, p. 36.
7. League for Programming Freedom as quoted in Brett Glass, 'Patently unfair?', *Infoworld*, 12, 44, 1990, p. 62.
8. Seth Shulman, 'Patent medicine', *Technology Review*, 98, 8, 1995, pp. 28–36.
9. Alexander E. Silverman, 'Intellectual property law and the venture capital process', *High Technology Law Journal*, 5, 1, 1990, pp. 157–192.
10. Nancy Perry, 'The surprising new power of patents', *Fortune*, 23 June 1986, pp. 73–83.
11. See Kerry Schott, *Industrial Innovation in the United Kingdom, Canada and the United States*, British North American Committee, London, 1981.
12. Gerald Udell, 'It's still caveat, inventor', *Journal of Product Innovation Management*, 7, 1990, pp. 230–243.
13. Brett Glass, 'Patently unfair?', *Infoworld*, 12, 44, 1990, pp. 56–62.
14. David Teece, 'Profiting from technological innovation: implications for integration, collaboration, licensing and public policy', *Research Policy*, 15, 1986, pp. 285–305.
15. David Teece, 'Capturing value from technological innovation: integration, strategic partnering, and licensing decisions', *Interfaces*, 18, 3, 1988, pp. 46–61.
16. W. Kingston (ed.), *Direct Protection of Innovation*, Kluwer Academic, Dordrecht, 1987.
17. A most excellent exception, wrought from a remarkable combination of legal and economic perspectives on patents and innovation, is Robert Merges, 'Commercial success and patent standards: economic perspectives on innovation', *California Law Review*, 76, 1988, pp. 805–876.
18. Merges, *op. cit.*, Ref. 6.
19. *Ibid.*
20. *Ibid.*, p. 876.
21. Michael Blackman, 'Taking patent information services to small and medium enterprises', *Intellectual Property in Asia and the Pacific*, 40, 1994, pp. 44–67, see p. 47.
22. Seth Shulman, 'Patent medicine', *Technology Review*, 98, 8, 1995, pp. 28–36.
23. Irwin Feller, 'Universities as engines of R&D-based economic growth: they think they can', *Research Policy*, 19, 1990, pp. 335–348.
24. Ian Harvey as quoted in David Harvey, 'BTG: the mother of invention', *Director*, September 1989, pp. 121–122.
25. Kenneth Labich, 'The innovators', *Fortune*, 6 June 1988, pp. 27–32, see p. 30.
26. Ronald Rothchild, 'Making patents work for small companies', *Harvard Business Review*, July-August 1987, pp. 24–30.
27. Report of the President's Commission on Industrial Competitiveness (1985) as quoted in Alexander E. Silverman, 'Intellectual property law and the venture capital process', *High Technology Law Journal*, 5, 1, 1990, pp. 157–192, see footnote 110.

28. Department of Defense Science Board Task Force on Export of US Technology, *An Analysis of Export Control of US Technology—a DOD Perspective*, Office of the Director of Defense Research and Engineering, Washington, DC, February 1976, p. iii.
29. Douglas Southard in Permanent Subcommittee on Investigations, Committee on Government Affairs, Senate Hearings, *Transfer of United States High Technology to the Soviet Union and Soviet Bloc Nations*, USGPO, Washington, DC, 1982, p. 53.
30. Theodore Wu, 'The citizen partner: a key force in effective strategic export control', *Signal*, August 1983, pp. 106–108.
31. C.W. Olney, 'The secret world of the industrial spy', *Business and Society Review*, 64, 1988, pp. 28–32.
32. See, in particular, Eric von Hippel, *The Sources of Innovation*, Oxford University Press, New York, 1988.
33. Stephan Schrader, 'Informal technology transfer between firms: cooperation through information trading', *Research Policy*, 20, 1991, pp. 153–170.
34. Manfredi La Manna, Ross MacLeod & David de Meza, 'The case for permissive patents', *European Economic Review*, 33, 1989, pp. 1427–1443.
35. Edwin Mansfield, 'How rapidly does new industrial technology leak out?', *Journal of Industrial Economics*, 34, 1985, pp. 217–223.
36. Donald Spero, 'Patent protection or piracy—a CEO views Japan', *Harvard Business Review*, September-October 1990, pp. 58–67.
37. Richard Levin, Alvin Klevorick, Richard Nelson & Sidney Winter, 'Appropriating the returns from industrial research and development', *Brookings Papers on Economic Activity*, 3, 1987.
38. Francis Tapon, 'A transaction cost analysis of innovations in the organization of pharmaceutical R&D', *Journal of Economic Behaviour and Organization*, 12, 1989, pp. 197–213.
39. C.T. Taylor & Z.H. Silberston, *The Economic Impact of the Patent System: A Study of the British Experience*, Cambridge University Press, Cambridge, 1973, p. 231.
40. William Miller, 'Productivity and competition: a look at the pharmaceutical industry', *Columbia Journal of World Business*, Fall, 1988, pp. 85–88.
41. Robert Merges as quoted in 'Patent plague', *Forbes ASAP Supplement*, 1993, p. 62.
42. Karen Howes, 'The shield and the sword', *Satellite Communications*, 17, 1, 1993, pp. 6A–9A, see p. 7A.
43. Don Lamberton, 'Innovation and intellectual property' in Mark Dodgson & Roy Rothwell (eds), *The Handbook of Industrial Innovation*, Elgar, Aldershot, 1994, pp. 301–309, see p. 307. See also 'The harm of patents', *Economist*, 22 August 1992, p. 15.
44. Alexander E. Silverman, 'Intellectual property law and the venture capital process', *High Technology Law Journal*, 5, 1, 1990, pp. 157–192, see footnote 62.
45. Geof Bowker, 'What's in a patent?' in W.E. Bijker & J. Law (eds), *Shaping Technology—Building Society*, Massachusetts Institute of Technology Press, Cambridge, 1992, pp. 53–74, see p. 61.
46. Brett Glass, 'Modem users, fear not; it's just the sound of patent attorneys', *Infoworld*, 14, 31, 1992, p. 81.
47. *Ibid.*
48. Brett Glass, 'Patently unfair?', *Infoworld*, 12, 44, 1990, pp. 56–62.
49. Laudeline Auriol and Francois Pham, 'What pattern in patents?' *OECD Observer*, 179, December 1992-January 1993, pp. 15–18.
50. Charles Moss & Ann Evans, 'Protecting ideas and new products', *Industrial Management and Data Systems*, September-October 1987, pp. 21–24.
51. Nancy Perry, 'The surprising new power of patents', *Fortune*, 23 June 1986, pp. 73–81, see p. 80.
52. Richard Gilbert & Carl Shapiro, 'Optimal patent length and breadth', *Rand Journal of Economics*, 21, 1, 1990, pp. 106–112, see p. 112.
53. J.J. Eaton & D. Bawden, 'What kind of resource is information?', *International Journal of Information Management*, 11, 1991, pp. 156–165.
54. E. Sciberras, 'Indicators of technical intensity and international competitiveness: a case for supplementing quantitative data with qualitative studies in research', *R&D Management*, 16, 1, 1986, pp. 3–14.
55. Michael Mann & Patrick Canary, 'Protecting innovation through patents', *Business and Economic Review*, 39, 2, 1993, pp. 25–27.

56. For example, Daniele Archibugi, 'The inter-industry distribution of technological capabilities. A case study in the application of the Italian patenting in the USA', *Technovation*, 7, 1988, pp. 259–274.
57. 'Hidden agenda', *Economist*, 20 November 1993, pp. 134–137.
58. J.D. Frame & F. Narin, 'The United States, Japan and the changing technological balance', *Research Policy*, 19, 1990, pp. 447–455.
59. Donald Spero, 'Patent protection or piracy—a CEO views Japan', *Harvard Business Review*, September–October 1990, pp. 58–67.
60. Giorgio Sirilli, 'Patents and inventors: an empirical study', *Research Policy*, 16, 1987, pp. 157–174.
61. For example, Pari Patel & Keith Pavitt, 'A comparison of technological activities in West Germany and the United Kingdom', *National Westminster Bank Quarterly Review*, May 1989, pp. 27–42.
62. Amram R. Shapiro, 'Responding to the changing patent system', *Research Technology Management*, 33, 5, 1990, pp. 38–43.
63. *The Importance of Protecting your Idea*, Litman Law Offices, Arlington, VA, n.d.