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**Bearing the Burden:
Small Firms and the Patent System**

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Abstract

The popular conception of the patent system is one of mad inventors with ludicrous inventions and equally absurd expectations that the product of their years of pottering in the garden shed will change the world. Precisely the same system is the bulwark of strategy in some of the world's most powerful companies, notoriously in the pharmaceutical industry, but now also in the world's IT industry. Can the one instrument serve such diverse purposes? Certainly those for whom the patent system is of critical strategic importance think so for they frequently declare that it benefits the independent inventor and the small firm. They insist that the patent system encourages the innovation of the weak as well as the strong, and that society is much the richer for this innovation.

This article considers just who does benefit from the patent system and then turns to the other side of the coin, the costs of the patent system. Most discussion of the system seems not so much to deny the existence of costs as to ignore them. Yet, the costs would seem to be considerable and their distribution as uneven as that of the benefits. Those who reap most benefits from the patent system are not those who incur most costs, and while benefits are finely focussed, costs are much more widely distributed. The greatest cost of all would seem to be borne by society as a whole in terms of damage done to innovation, which is curious given that the fundamental purpose of the patent system is to encourage innovation for the benefit of society as a whole.

Keywords: small firms, patents, innovation, strategy, costs, benefits.

1. Introduction

1.1 The Conventional View of Patents

The patent is the instrument of the intellectual property system best known and most closely associated with innovation. The patent is the outcome of a bargain between the inventor and society by which society grants the inventor certain rights to his invention in return for the inventor's disclosure of whatever it is he has invented (see Taylor and Silberston; 1973). Without these rights, it is conventionally argued, the inventor would be unable to reveal his invention for fear that others would steal it. Consequently, the inventor would have little incentive to invent, and society would forego the invention and all its benefits. Thus, the patent system neatly offers the inventor the opportunity to reap some reward from his invention, and provides society with an invention it would not otherwise have had. Everyone benefits, or so it is said.

The patent system bestows its benefits by giving intangible resources - the information of invention - the legal status of tangible property. This is daunting stuff, usually left to those lawyers and economists who are patent experts. And yet, there are many other fields with an interest in innovation: in the sciences, any branch of engineering; in the arts and humanities, anything to do with creativity; and in the social sciences, any of a wide range of subjects from management studies to technology policy, from sociology to politics. Indeed, it is hard to think of an area in which innovation (broadly defined as change) is not a major interest, and innovation, be it remembered, is supposed to be the whole purpose of the patent system. It is innovation - not invention - that society wants, and it is

for innovation that society has devised the patent system. While the experts are engrossed in the niceties of the patent system, the complications and implications of the system pass virtually unnoticed in the world at large, masked by the simple assumption that the patent stimulates innovation, and - equally innocent - that something would surely be done about the system if it did not (see Thurow; 1997). The patent system is taken on trust, vaguely perceived as beneficial, and if not beneficial, at least benign.

1.2 Patents in Practice

The patent has a long and dishonourable history, used as much to reward political loyalty as invention. It has provided the means to award profitable monopolies to friends and cronies as much as to entrepreneurs. Enterprise has flourished during periods when the patent system has fallen into neglect, and has overcome even its complete absence. Invention has survived the perversion of the system to fit the requirements of communist ideology, and still survives peculiarities in the regulations of various national patent regimes. In short, the purity of the patent system is a modern construct.

The basic patent bargain works only in theory. In practice, both sides cheat. Most obviously, the patent affords protection only when the patentee can afford to enforce his rights, which may mean that the poor have no protection at all (see Mansfield, Schwartz and Wagner; 1981). As the journal *Nature* (1929) noted long ago: '... the consideration for which patent rights may be enjoyed is nowadays not so much the introduction of a new invention as the possession of exceptional wealth'.

And if society cheats in not providing the protection the inventor has a right to expect from the patent system, the inventor cheats too. Only in theory does the inventor provide society with the information of invention: in practice, he discloses the information required by the patent system, not the information required by society to replicate and develop his invention. 'A company's patent lawyers can protect the company's proprietary position without giving away too much in the application process' (Labich; 1988, p.30).

The patent specification is primarily a legal document, not a source of information for innovation. One respondent to a survey of professional engineers who had taken out patents encapsulated the situation nicely: 'I could barely recognise my own invention in legalese' (Mandeville; 1982, p.12). Basically, the information contained in patent specifications is available only to those who consult them directly, or who pay others more adept at arcane classifications and the language of lawyers to do so (Liebesny; 1972). Moreover, the delay between the filing of an application and the publication of a specification may be far greater than the pace of change in some industries. In high technology - an activity often associated with the patent system - the passage of time rapidly erodes the value of information. In addition, the criteria by which patents are granted pay no heed at all to the contribution patent information might make to innovation. Details of inventions which can make no conceivable contribution are frequently published, as are those of patents designed to mislead or obstruct (Schmookler; 1957).

The strategic use of patents has meant that those firms and industries in which the patent system has been little more than an irrelevance are no longer able to opt out of the system. While once the semiconductor industry, the basis of the IT industry, innovated regardless

of the patent system, it now patents heavily (Hall and Ham; 1999; Grindley and Teece; 1997). Where once only large pharmaceutical firms let their patenting dominate their overall strategy, now firms in many other industries are forced to exploit the patent system strategically. It takes only one firm in an industry to sue for infringement to encourage other firms to protect themselves by counter-suing. The IT industry has seen more than its share of such activity: for example, Lucent Technologies, the owner of Bell Laboratories, once famously free in its attitude to patent licensing, now has 266 employees 'to make a profit from licensing patents to companies that come to us for a licence or that we discover have in fact used our patents in their products and have not come to us for a license' (Rubenstein; 1998). The patent system now shores up IBM, Intel and Microsoft as much as it ever reinforced Merck and Glaxo. Patent royalties are now the most profitable of IBM's product lines and have provided most of TI's revenue in recent years (Rivette and Kline; 2000, pp.58,125).

The IT industry has also witnessed expansion of the scope of patents to cover software. The basic principle that whatever is done by computer should be patentable combined with the extension of computer power to do just about anything (see Merges; 1997), has meant that just about any software can be patented, and - contrary to popular opinion - in Europe as well as in the United States (Beresford; 2000). '[A]ttorneys 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' (Gibson, 1992, p.36). Software patents granted in the US have increased by 30% annually over the last decade (Shulman; 1999a, p.71). Nearly a third of the patents granted to IBM in 1997 were software-related (Puttre; 1998). And from the patentability of microbes nibbling their way through oil slicks (Kass; 1982), the argument that other life forms are patentable has been hard to resist. Plant genes are now patented, whether their sequence has been unravelled in the laboratory, or simply found in nature. Sounds, smells and colours can be patented in the US (Shulman; 1999b). Even mice can be patented (Kevles; 2002). And so with business methods, originally patentable in the US in that they were an application, and therefore an extension, of computer programming (Shulman; 1999a, p.72). In Europe, business method patents are allowed if they make a technical contribution, not that the European Patent Directive defines 'technical' (Aharonian; 2001). But there are few business methods that are not, or cannot be, expressed in a manner that can be captured by a computer and therefore patented. There were 2,700 applications for business method patents in the US in 1999 and 7,900 in 2000 (Frieswick; 2001). US patenting applications using the word 'Internet' grew from 385 in 1997 to 1,667 in 1998 and to 2,598 in 1999 (Hazelwood; 1999). In short, patenting has never been so prolific, nor so promiscuous.

Exploited in this way, the patent system is ripe for abuse. The patent system has long been abused and it should not be surprising that the patent system is still being abused. The wonder is that anyone should think otherwise, and this article will speculate on just why this might be. The article will argue that the strong are most able to exploit the patent system and that they have a great deal to gain from this exploitation. The article will also argue that this exploitation is hidden - deliberately hidden - from those who bear its costs. Basically, the strong disguise their own interest in the patent system by emphasising

society's interests in the system, and the benefits for the weak. Thus, the chairman of both Reed Elsevier and the European Round Table, a grouping of European leaders of business, declares that: 'Protecting intellectual property is crucial, not so much for large companies but for small and medium sized enterprises' (Morris Tabaksblat as quoted in Betts and Groom, 2001, p.1).

1.3 Benefits for the Weak - Some Empirical Evidence

In theory at least, the system is particularly appropriate for encouraging the invention of small firms and independent inventors. Large organisations are more likely than small to have the internal resources to develop their own inventions, and so can keep the information of invention to themselves. Smaller organisations must generally seek these resources outside and so must reveal all. In practice, though, the protection the patent system affords the weak against the strong is often illusory, and the problems small firms encounter in protecting their inventions through the patent system are widely acknowledged. There is much less questioning of the advantage they and their innovation are claimed to reap from the other part of the patent bargain, the information the patent system makes available. A considerable volume of writing exhorts SMEs to make much more use of the patent system for information, typically noting that SMEs lack information and that the patent system has plenty. Distinct from this promotional literature, sometimes naïve, sometimes shameless, are just a few surveys that find a chasm between the information supply of the patent system and the information demands of SMEs (e.g., Arundel and Steinmuller, 1998; Hall, Oppenheim and Sheen, 1999, 2000). Small firms cannot depend on vast R&D departments to generate the information required for invention; they must look to external sources for this information and one of the richest of these is said (certainly by patent officials) to be patent specifications.

'Patent specifications are a source of valuable technical information, readily available and much of it *free* for the taking. It is a pity that *so few* manufacturers, engineers and scientists seem to be aware of this. So next time you have a technical problem, check to ensure that it has not been solved already. Even if you don't find a ready solution, you may pick up some good ideas for use in your current or future design' [original emphasis] (Australian Patent Office; 1981, p.2).

'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' (Blackman, 1994; p.47).

Such assertions are in conflict with the evidence. Two postal surveys were carried out in October 1996, one of the 615 UK small firms (employing between 10 and 250) that had been granted at least one patent in the UK or Europe in 1990, and a control group of 2,000 small manufacturing firms in the UK. The overall response was just under 35%. Predictably, these small firms look to customers, suppliers and competitors for information about the latest developments in their industry and market (Figures 1a and 1b). All other likely sources of external information vie with each other in their uselessness for innovation in small firms, which is interesting in that many of these sources take some pride, and expend considerable public resources, in their efforts to

provide information to small firms. Most successful in this unenviable competition are government sources and the patent system. Small firms that have patented declare the patent system to be somewhat less useless than do small firms in general, but the positive side is not encouraging for those who feel that the patent system is obviously a major source of information for innovation in small firms: while just 8% of the small firms in the control group think patent information of some importance, only 12% of small firms that patented, and that therefore have some familiarity with at least the protective side of the system, consider patents to be of some importance as a source of information for innovation.

It is often argued that the other forms of intellectual property protection - registered designs, copyright and trademarks - being simpler devices, are of more practical use to small firms than patents. This would seem to be questionable. These small firms do not see any form of intellectual property protection as important to their innovation (Figures 2a and 2b). What is most remarkable is that even those that have patented, and therefore have some knowledge of intellectual property rights, are only slightly more likely to see the other forms of intellectual property protection as benefiting their innovation. In both cases, trademarks and trade secrets are a little more valued than copyright and registered designs, but the difference is marginal and is overwhelmed by the vast majority of small firms considering that all forms of intellectual property protection are of little importance for their innovation.

Most of the firms surveyed because they had been granted a patent in 1990 had since acquired other patents - but not many. On average they had been granted but one other patent, and only 13% had more than 10 patents. About half did not apply for patents even on inventions they thought were patentable. Two-thirds had developed their invention since patenting it in 1990, but 87% would have developed the invention even without a patent. Predictably, development is almost exclusively in-house rather than in partnership. Licensing patents to others is not a popular course; 81% of small firms granted a patent in 1990 have not licensed it. Nor has the vast majority licensed patents from anyone else over the last ten years. Not a single firm could boast that it frequently licensed patents from others. Of the few firms that did occasionally license, most gained know-how as part of the agreement, but the licence also imposed restrictions on what they could do with the technology. Most common among these restrictions were agreements not to sell outside a geographical area, not to dispute patents, not to sell competing products, and agreements to buy parts from the licensor and to license back improvements.

About half of these small firms regularly conduct patent searches and almost all of these pay a patent attorney to search on their behalf. The most important reason for doing this is to keep track of competitors, but the next most important reasons are to check on potential patent infringements and to prepare patent applications (Figures 3a and 3b). It has been noted by others that some of the most significant uses to which the patent system is put are demanded by the patent system itself (Australian Patent Office; 1980). When this happens, the patent system is serving not the requirements of innovation, but its own requirements. Even the small firms that search to keep track of competitors are more interested in keeping track of their competitors' patenting than their competitors' technology.

These two surveys paint a somewhat depressing picture of small firms isolated from the external sources of information for innovation that larger firms and firms in rapidly-innovating sectors find so important. These small firms seem to rely very heavily on their own resources. There is a range of likely reasons for this, but basically they come down to employees of small firms, and especially senior management, having few resources available to search for information in the outside world and to use the information acquired there. In a small firm, everyone is needed for day-to-day operations, to man the pumps. It should come as no surprise that small firms are highly innovative; their innovation is a necessary response to competition and the fluidity of their markets. Patent protection is little valued and innovation is rife in its absence (Kahaner, 1983). And among a host of information sources that small firms might use for innovation and rarely do, the patent system is distinctive in being used least of all.

1.4 Who Does Benefit?

It is now more than a decade since Mansfield published his classic table illustrating the importance of the patent system to the innovation of various industries (Table 1). The Table shows some industries to be very much more reliant on the patent system than others. Basically this is because the invention of these industries is readily codifiable (Levin, Kevorick, Nelson and Winter; 1987). This means both that competitors can easily acquire and use the information of invention, and also that the invention can be thoroughly described in a patent specification. 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 (Tapon; 1989). Hardly surprising then that Taylor and Silberston (1973, p.231) could conclude that the 'pharmaceutical industry stands alone in the extent of its involvement with the patent system'. That was thirty years ago; other industries now rival the pharmaceutical in their involvement with the patent system, though the pharmaceutical industry remains outstanding in the close association of its patenting with its innovation (Macdonald; forthcoming).

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: Mansfield; 1986

Set against the benefits society reaps from innovation in those industries where innovation is encouraged by patents must be the monopoly costs these industries insist provide the necessary incentive to innovate. Less obvious is the cost to all those other industries where innovation is not dependent on patent protection, but that must still cope with a patent system that is virtually irrelevant to their requirements. Of course, it can be argued - it is argued - that firms everywhere benefit from the information disclosed and disseminated by the patent system. The argument is much more convincing in theory than in practice. Just as small firms have little use for patent information, large firms in all but those few industries where invention can be neatly encapsulated in a patent specification, attach little value to patent information. It has been calculated that patent information is worth about 0.75% of firms' research and development (R&D) expenditure, and thus an infinitesimal proportion of total innovation costs (Taylor and Silberston; 1973, p.212). This may help explain why there is such toleration of the poor dissemination of patent information; it is just not worth the spreading.

5. Invention or Innovation?

An invention is a discovery: an innovation is a product or service that is new to the market, or simply new to the adopter (see Schott; 1981). It is important to remember that of the total resources required for innovation, only a small proportion comes from invention; the majority comes from design, production, marketing, and the rest of the myriad of activities that contribute to the making of things. This assumes, of course, that every invention contributes something. It does not. Many inventions make no input to any innovation.

‘Although most innovations can be traced to some conquest in the realm of either theoretical or practical knowledge that has occurred in the immediate or remote past, there are many which cannot. Innovation is possible without anything we should identify as invention, and invention does not necessarily induce innovation, but produces of itself.... no economically relevant effect at all’ (Schumpeter; 1939).

This failure to achieve the ultimate goal of successful innovation is often blamed on what is seen as a rocky road from invention to innovation. Alternative models avoid the notion of a journey, of linearity (Teece; 1988). These maze models of innovation depict no 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 - if it 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 (Rothwell; 1992, 1994). In the midst of both linear models and maze models is the patent system - seen as a convenient stretch of fast highway in the former and as a further complication in the latter.

Society may want innovation from its patent system very much indeed, but the patent system is really concerned only with invention (Kingston; 1987). This desire for innovation has produced two arguments in justification of the patent system. Though they

are not incompatible, they are seldom presented together (Merges,;1988). 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. Development is the inventor's responsibility, not society's. 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 (Merges; 1988). Society must then use this information to create innovation, and development, with all its uncertainty and irregularity, becomes society's responsibility, not the inventor's. In the first case, society is to get innovation, which is what society really wants: in the second, only information. In the first case, society allows the inventor to make his information public: in the second, society demands that he make his information public. The first case supposes patent information leading directly to innovation and that innovation is society's reward: this is compatible with linear models of innovation. The second fits better with maze models of innovation in that it depicts 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.

1.6 Participants in Process

While maze models come closer to the reality of innovation than linear models, there are those who prefer to see innovation as the culmination of a linear process. Society generally - and naturally - prefers this simple and direct model of innovation, and the passive role it is required to play. Often, though, this perception is encouraged by the observer's situation, and often it is in his own interest. For example, scientists involved in basic research like to think of their activities as seminal to innovation. And so do the universities and the research laboratories that house the scientists. Similarly, managers who allocate organisational resources for innovation like to feel they are fuelling a process that will produce the innovation they have planned and none of the uncertainties often associated with change; they need to justify resource input in terms of innovation output (see Greiner & Barnes; 1970). And thus it is with public servants anxious to encourage innovation and expected to account for the expenditure of public funds on research in terms of the innovation it will yield (Griliches; 1989). Patent attorneys and those who work for patent offices also have vested interests in the system. More generally, so do those who find the prospect of rampant, uncontrolled and unpredictable innovation disconcerting. For them - and there are many of them - the patent system provides an illusion of certainty in an uncertain world. Amidst the turbulence and tumbrels of even high technology revolution, it is comforting to feel that, even in innovation, there is a proper and established way of doing things. '[T]he very idea of a patent law is something of an oxymoron: it is a hybrid of two opposing principles, change and order, that live always in tension with each other' (Kass; 1982, p.43). To this considerable body of interest in perceiving a linear innovation process must be added those for whom innovation actually is a linear process. There are whole industries whose innovation is strongly influenced, if not actually determined, by what happens in research. In these cases, innovation is indeed a process, almost a routine in which output is

basically a product of input. It behoves such industries to spend heavily on research and to protect as best they can not only their innovation, but also the systems on which their innovation, and hence their competitiveness, are dependent. The lengths to which these industries will go to protect the patent system are a measure of how crucial it is to their existence. Their position is not negotiable.

Consider the recent unequivocal declaration from the president of one large pharmaceutical group. ‘Les produits génériques sont des actes de piraterie qui seront éradiqués comme l’avait été la piraterie au XVII siècle’ (quoted in Cohen; 2001). For such industries, the patent system is so compatible with their method of innovation, so integrated with corporate strategy, that it has to be defended at all costs. Attack has been the customary form of defence, the aim being to secure strategic position not simply by maintaining the patent system, but by strengthening it. The size of the pharmaceutical industry, its potential to contribute to public welfare, and its experience with R&D make the industry a force to be reckoned with (Miller; 1988; Porter; 1989). It is quite capable of using this power to extort advantage for itself and to impose costs on others.

‘We are most interested in a strengthening rather than weakening of the Australian patent law, especially for pharmaceuticals. Substantial weakening might prompt us to drastically shortcut investments in Australia’ (quoted in Mandeville and Bishop; 1982, p.16).

‘The danger is that loss of patents in HIV alone could destroy the global HIV market. The bigger danger is that the broader loss of patents in South Africa could be the thin end of the wedge which smashes patent protection for the industry [worldwide]. And if that happens, then frankly the entire economic base of the pharmaceutical industry is destroyed’ (David Ebsworth, Head of Pharmaceuticals in Bayer as quoted in Pilling; 2001).

Before the strengthening of the patent system, society looked to high technology for a model of how to innovate, not the only or necessarily the best model, but a model that certainly worked.

The model was based firmly on the notion that innovation was dependent on the free flow of information. So rapid was the pace of change in semiconductors that the patent system played little part in the transformation. Indeed, the companies that accumulated most patents tended to go out of business, leaving the field to companies much less distracted by patenting (Table 2).

‘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’ (*Forbes ASAP Supplement*; 1993, p.62).

Table 2. Percentage of total semiconductor patents awarded to firms in the US,

1952-6

	1952	1953	1954	1955	1956
Bell Laboratories	56	51	46	37	27
Established firms	37	40	38	42	53
New firms	7	9	16	21	20

Source: Braun and Macdonald; 1978, p.68.

The way in which high technology firms innovate now is very different and has been profoundly altered by the patent system (Simon; 1996). 'Software patents are failing to achieve the Constitutional mandate of promoting innovation and indeed are having a chilling effect on innovative activity in our [software] industry' (Shulman; 1995).

1.7 Strengthening the System

In the early 1980s, governments turned somewhat desperately to technology to create wealth and employment. As the President of the Pharmaceutical Research and Manufacturers of America (PhRMA), and sometime Commissioner of Patents and Trademarks, noted:

'The shift in the U.S. competitive advantage, away from basic manufacturing and toward high-tech information-based industries such as pharmaceuticals, makes global intellectual property protection an urgent policy priority for the U.S. government and for U.S. industry' (Mossinghoff and Bombelles; 1996, p.47).

Innovation was the key to competitiveness, but government policy (and corporate strategy for that matter) found difficulty accommodating the undisciplined information flow fundamental to the innovation of a freewheeling Silicon Valley. Policy and strategy were much more comfortable with an interpretation of high technology entrepreneurialism that flaunted the trappings of Silicon Valley in the science park or the European Commission's Esprit Programme (Macdonald; 1987; Marschan-Piekkari, Assimakopoulos and Macdonald; forthcoming) while denying the unmanaged and uncontrolled information flow critical to innovation in high technology. The information required for innovation was to be captured and retained, whether in a Fortress Europe defended by the national champions of the electronics industry, or a Fortress America, where alarm at the Japanese and even European threat to competitiveness led to the imposition of national security export controls designed to prevent the loss of high technology information (Macdonald; 1990). At the corporate level, information mercantilism also prevailed with innovation strategy based on the acquisition and retention of information (Macdonald; 1998). Clearly, this climate was hostile to the patent system disseminating information widely for the use of others, but not to the patent system providing a temporary monopoly so that inventors could innovate. The climate was conducive to the strengthening of the patent system.

Pressure to extend the scope of patents was fuelled by the observation that much modern invention did not fit easily within the system's arcane classification. The scope of patents had to be extended if the system were to stimulate the innovation a modern economy

requires. The patenting of genetic material is one result, the extension of the patent system to computer software and to business methods in the United States two more. The value of the patent monopoly is related not just to the scope of the patent, but also to the ease with which the patent can be defended. The US Court of Appeals of the Federal Circuit (CAFC) was established in 1982, a response to the need for a specialist body to cope with the growing complexity of some of the new areas into which patents were entering. The Court was also a product of powerful groups looking after their own interests. '[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' (Silverman; 1990, fn.62).

It is argued that the actions of the CAFC have very much strengthened the patent system. Between 1982 and 1987, the CAFC upheld 89% of district court decisions that patents were valid: between 30% and 40% had been upheld previously (Silverman; 1990). Penalties for infringement have become very severe:

'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' (Perry; 1986)

The result has been to increase the value of an American patent, and therefore the value of other patents.

This increase in both the scope and the scale of patent protection has altered the relationship between the conflicting interests inherent in the system. A weak patent system acknowledges that invention is generally a long way from innovation and of little value in itself: a strong patent system values invention - patented invention - perhaps even above innovation. Texas Instruments, for instance, once liberal in its cross-licensing arrangements with competitors, has become particularly litigious. Its most profitable product line is now patent royalties. In some years, the company's licence fees exceed its operating income (Thurow; 1997). IBM increased its licence income from \$30 million in 1990 to nearly \$1 billion in 2000 (Rivette and Kline; 2000). Other semiconductor companies have converted the cross licensing that used to stimulate innovation in the industry into a mechanism for excluding new entrants and inhibiting innovation (Barton; 1997). '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' (Howes; 1993, p.7A). The balance of the system, then, has been tilted in favour of the benefit to society being expected less from the information made available for innovation, and more from the protection given the inventor to innovate himself.

This shift is evident in a growing tendency in the US to regard the commercial success of innovations as a major determining factor in the granting and upholding of patents (Merges; 1988). Thus, those organisations best equipped to innovate in a fashion compatible with the patent system, rather than merely to invent, find most value in the

system. These are likely to be large firms. Being well equipped to innovate themselves, there is little need for these firms to disseminate their information to society so that society may innovate. In short, strengthening the patent benefits the large firm whether it innovates itself or licenses the patent to others: for the weak, able neither to innovate themselves nor to protect their property, strengthening brings no benefits.

‘....[A]n 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’ (Merges; 1988, p.876).

‘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’ [emphasis added] (Silverman; 1990, fn.110).

1.8 Standing up for the Weak

The patent system is much more suited to pharmaceutical and chemical firms than to most others, and these firms gain rather more benefits from the system than others. This would be of no great moment in a world which does not even pretend to be fair were pharmaceutical and chemical firms not disposed to defend their advantageous position by presenting their own innovation as typical of all innovation. Thus, because the pharmaceutical industry spends a fortune on R&D, the industry feels entitled to pontificate on innovation in general and on national competitiveness too.

‘Since, today, it takes an average ten years and over \$100 million to develop a new drug, only seven or eight years are left for the product to recover its entire investment before manufacturers who made no R&D investment at all are free to copy and compete with it. In the United States, the 1984 Patent Restoration Act has added up to five years of life to a pharmaceutical patent to make up for some of the time lost in the governmental approval process..... If the United States is to avoid further erosion of its competitive position, a new framework for growth must be envisioned in which intellectual property rights are protected and in which investment and innovation are encouraged’ (Miller; 1988, p.88).

This is arrant nonsense: the innovation of the pharmaceutical industry is not representative of innovation as a whole, and the patent system that is so conducive to pharmaceutical innovation is much less appropriate for other innovation. This leaves other industries with the option of adapting their innovation to resemble the routine processes of the pharmaceutical industry (an option that has never been realistic), or of adopting not the innovation of the pharmaceutical industry, but its use of the patent system

In the IT industry, for example, companies look to the patent as a weapon in their strategic armament. In some industries, the patent can become a tool reminiscent of the

instruments employed in the world of high finance, and having as little to do with the reality of innovation as dot.com companies. Indeed, innovation may well be discouraged as inimical to the effective use of patents in strategy. Such games, originally devised in the pharmaceutical industry, have evolved a depressing sophistication in other industries. They are games for big companies (Macdonald; forthcoming). The weak are neither invited, nor able, to play. In their innocence, they still expect the patent to have something to do with innovation. 'Indeed, it may fairly be claimed that the provisions of the new law [the Copyright Designs and Patents Act 1988] reflect the interests of the powerful and politically active, not those of society as a whole' (Porter; 1989).

1.9 The Costs of Patents

Discussion of the costs and benefits of the patent system tends to emphasise the benefits. The costs of the patent system are usually ignored altogether, or are presented as trivial. Those most commonly acknowledged are the fees paid to patent offices and to patent attorneys. But there are other costs. There are serious costs. These would seem to be of two sorts:

1. *The costs of illusion.* The illusion is that the patent system really will deliver the protection and the information it is supposed to deliver. These costs are likely to be heaviest for those who are new to the patent system, and lightest for those who have most experience. The costs of illusion also encompass the costs society incurs in frustrated expectations of innovation.
2. *The costs of distortion.* The patent system is supposed to help meet society's requirements for innovation. Society is not supposed to meet the patent system's requirements, yet this is what happens when resources are diverted from other purposes, including innovation, to satisfy the demands of the patent system. Recall the use of patent information in the small firm survey; it was required not for innovation at all, but to service the patent system. Recall also that the patent system suits the innovation process of a few specialised industries, not the irregularity that is much more typical of innovation generally. In as much as this irregularity is compromised by being tailored to suit the patent system, there is a cost in terms of discouraged innovation.

1.9.1 The Costs of Illusion

Macroeconomic analysis of the patent system focuses on its net value to society. 'If the system accounts for a net increase in inventions having a value to society exceeding the costs society pays for them, the patent system is justifiable in economic terms' (Markham; 1962, p.597). A positive net social value does not require costs and benefits to be evenly distributed, but great benefits for some must entail equally great costs for others. The more stringent the system, the more these benefits would seem to be concentrated among those whose innovation accords with the system, and the greater the costs for those whose innovation does not. Most obviously, the costs of avoiding infringement rise.

'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' (Moss and Evans; 1987).

Any lengthening of the patent term obviously benefits those awarded patents, but less obviously increases both the risk of infringement and the search costs of others seeking to reduce this risk. '[I]nventions 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' (Gilbert and Shapiro; 1990, p. 112).

From this perspective, the information the patent system has accumulated is less a contribution to innovation than 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' (Perry; 1986, p.80).

'Genetics Institute's patent counsel say the strength of the potential patent position is 'a leading factor' in deciding what research to pursue' (Rivette and Kline; 2000, p.58).

Society's approach to innovation - which is what the patent system exemplifies - has gone very seriously wrong when lawyers decide research priorities, or when property is so valuable because it is protected by patent that industry strategy focuses on defending this property, even at the expense of creating new wealth. A whole vocabulary has developed to describe the role of patents in corporate strategy; amidst patent clustering, patent bracketing, patent walling and patent blitzkrieg there may be little place for innovation.

Because patent statistics are now taken so seriously, 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 (Shapiro; 1990). A minor industry has developed to tally patents, a practice justified by the observation that patents are one of the few indicators of output from expenditure on innovation. Undeterred by the fact that patents, if they measure anything at all, measure invention rather than innovation (see Rosenberg; 1974; Wyatt; 1977-8; Sciberras; 1986), this minor industry counts patents to compare the technological and competitive strength of companies, industries and whole nations. Share prices rise on news that a patent has been granted, and fall on news that it has been challenged. So secure are profits from pharmaceutical patents that plans are afoot to use them as financial instruments by issuing notes on them to investors (Rivette and Kline; 2000). The wonder is that all this activity can take place in the complete absence of innovation. Innovation has in many ways been supplanted by the patent, which, in itself, creates no wealth at all.

'I'm convinced that the management of intellectual property is how value added is going to be created at Xerox. And not just here, either. Increasingly, companies that are good at

managing IP will win. The ones that aren't will lose' (Richard Thoman as quoted in Rivette and Kline; 2000, p.54).

1.9.2 The Costs of Distortion

Whenever resources are diverted from one purpose to another to satisfy the requirements of the patent system, and when the incentive to patent becomes distinct from the incentive to innovate, there is likely to be a cost in terms of discouraged innovation (Takalo and Kanninen; 1997). Universities, certainly in the UK but elsewhere as well, are anxious to increase their revenue not only because they are expected to cover costs, but also so they can demonstrate demand for their services and, therefore, just how useful these services are. Patenting is seen as an appropriate route to riches, and academics are encouraged to patent whatever can be patented. Resources are diverted from areas with little patenting potential to those with more, and publishing is discouraged if it might interfere with patenting prospects (Feller; 1990). The British Technology Group, which specialises in exploiting university patents, is especially keen to suppress academic discussion. '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' (Harvey; 1989). Academics are unlikely to be innovative unless they are free to discuss and exchange ideas. If information flow is being restricted in universities by the requirements of the patent system, then it is unlikely to be flowing freely in other organisations.

The patent system also sets precedent for the appropriation of information by the organisation. The patent system is highly compatible with management methods that focus on the control of information as an organisational resource; with knowledge management, management information systems and the codification of information in IT, for example. There is no place here for personal exchange networks; these are now regarded as organisational property. The Silicon Valleys of the industrial world, and the invisible colleges of the academic, cannot function under such a regime; they wither and die.

2. Concluding Thoughts

Nonsensical as it may sound, the patent system is essentially anti-innovative. This is not just because it assists a very specialised sort of innovation and discourages other sorts. Much more important is that the patent system satisfies the requirements of those who need to feel that innovation is controlled and contained, that innovation is in its place, part of process. Most innovation is not like this at all.

This is not to say that the patent system should be changed. Small business counsellors, enterprise consultants and patent office officials proffer advice on how to use the system better, and on how it might be adapted to offer even better service to users. They argue that, while the fundamentals of the patent system are sound, there is always scope for improvements that would increase the benefits for everyone. For example, there has been much discussion of the merits of rewarding employee inventors (Littler and Pearson; 1979; Orkin; 1984). Such trivial tinkering distracts attention from matters of moment (Polanyi; 1943). The system is inherently imperfect, and fundamental improvement is just not possible. This is why enthusiasm for the system among economists is often so muted.

‘If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it’ (Machlup; 1958, p.80).

In other words, this is as good as it gets.

It may not, though, be as bad as it gets. While the role of patents in innovation may not be about to increase, there would seem to be considerable potential for the expansion of their role in strategy. While they may offer the occasional opportunity for the weak to impede, and thus profit from, the innovation of the strong, this is a role demanding the resources of clever lawyers, accountants and consultants. Just as there is no necessary place for innovation in the strategic use of patents, there is no obvious place for the entrepreneur.

‘In the context of patents, one way of avoiding disputes with other patentees is to avoid innovating and producing in areas where others are present’ (Lanjouw and Lerner; 1997, p.21).

‘That’s the key: no exposure.... While we can sue for infringement, we can’t be countersued because we’re not making or selling any products, so there’s no way we could possibly be infringing anyone else’s patents. Our only “product”, if you will, is intellectual property’ (Mark Lieberman as quoted in Rivette and Kline; 2000, p.135).

This does not mean that there is no possibility of increasing the public benefit from the patent system. Appreciating the limitations of the system would achieve a great deal. Managers of pharmaceutical companies might sleep less soundly at night, but appreciation would not actually reduce the benefits their companies reap from the system, at least not in the short run. It is surely as well that those who bear the costs of the patent system appreciate the nature and extent of these costs. Appreciation in itself would do much to reduce them (see Rothwell; 1983). This appreciation starts with seeing the patent system as it is, and not as others would have us see it. Consider Macaulay’s nice observation on the impact of copyright on Dr Johnson’s productivity, and consider what such realism might contribute to modern discussion of the relationship between intellectual property and innovation:

‘Would it have stimulated his exertions? Would it have once drawn him out of his bed before noon? Would it have once cheered him under a fit of the spleen? Would it have induced him to give us one more allegory, one more life of a poet, one more imitation of Juvenal?’ (Anon; 1978).

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Appendix

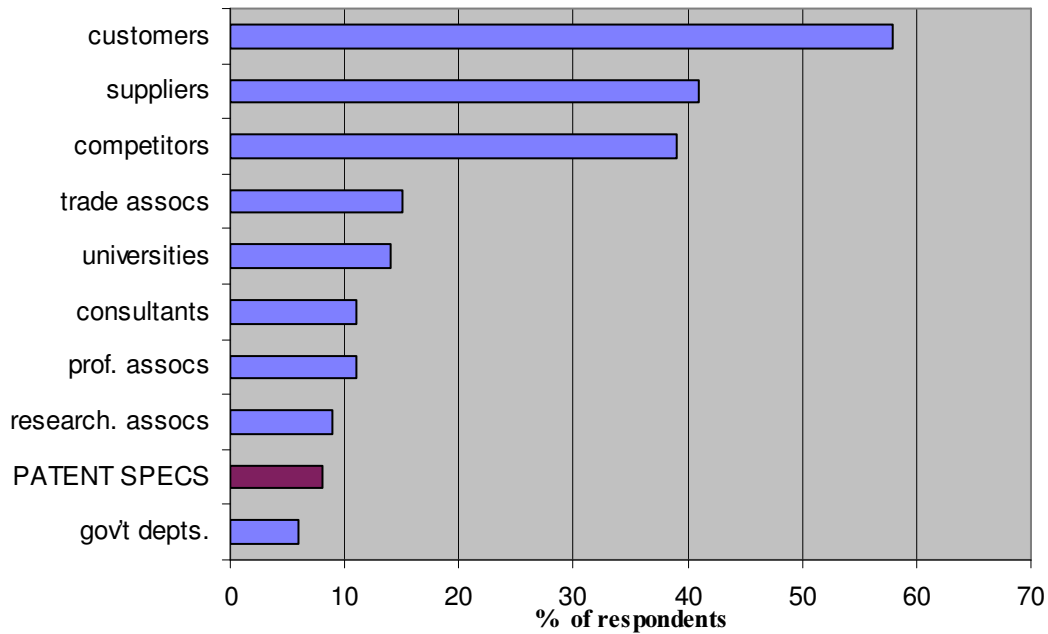


Figure 1a: External Sources of Information Rated Important for Innovation in SmallFirms

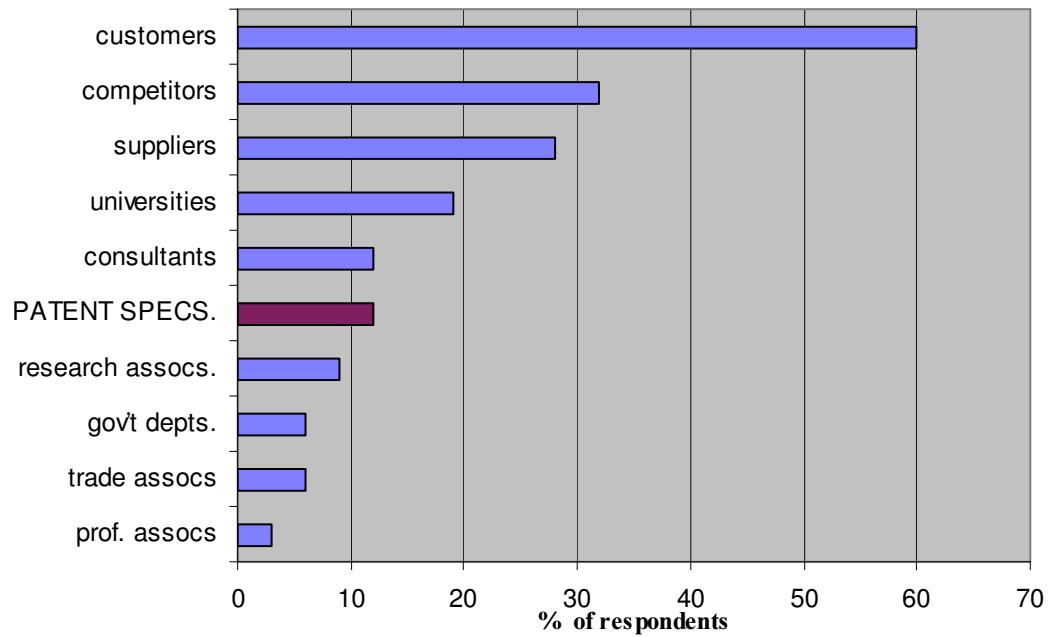


Figure 1b: External Sources of Information Rated Important for Innovation in Patenting Small Firms

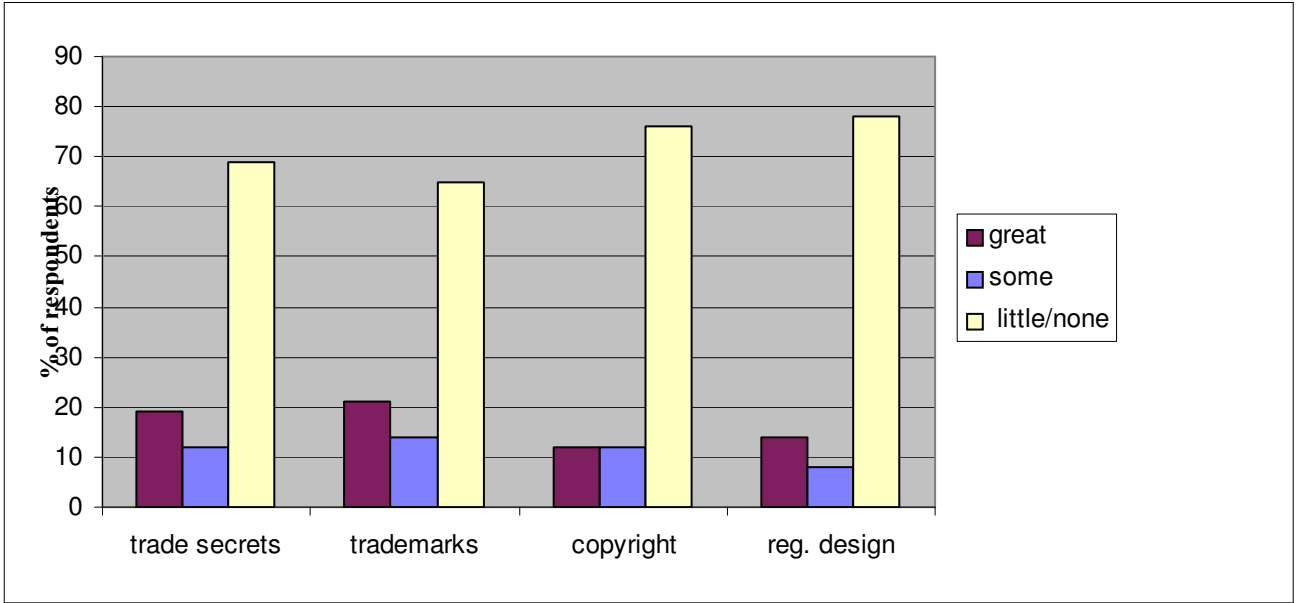


Figure 2a: Benefits to the Innovation of Small Firms from Other Forms of Intellectual Property Protection

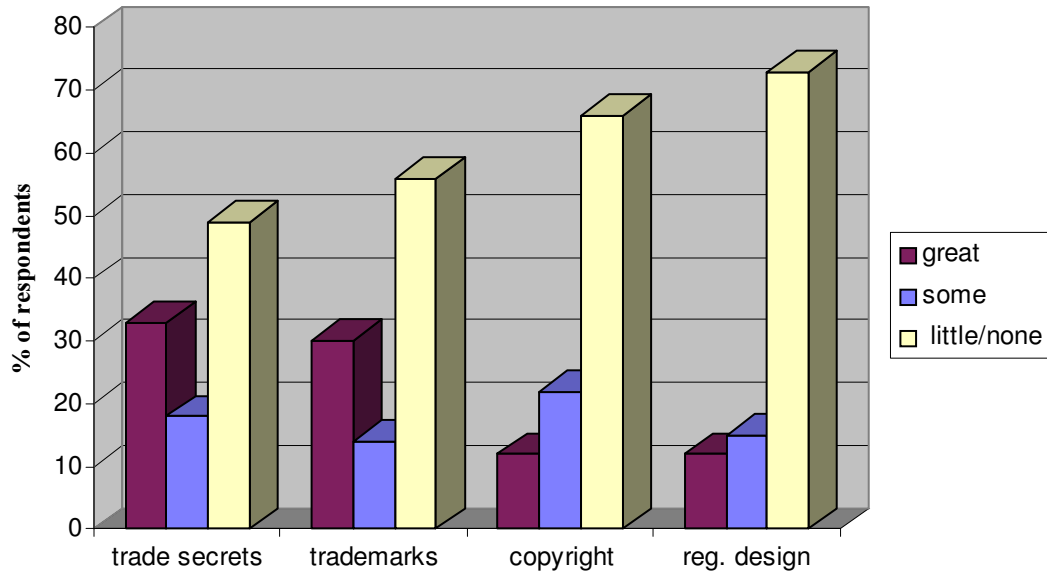


Figure 2b: Benefits to the Innovation of Patenting Small Firms from Other Forms of Intellectual Property Protection

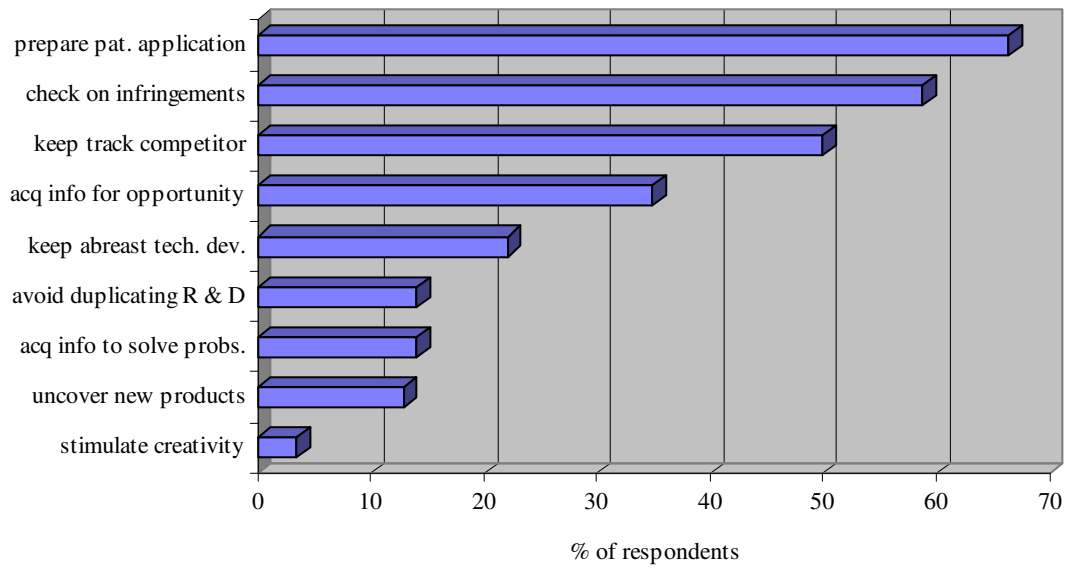


Figure 3a: Why Patent Searches are Conducted by Small Firms

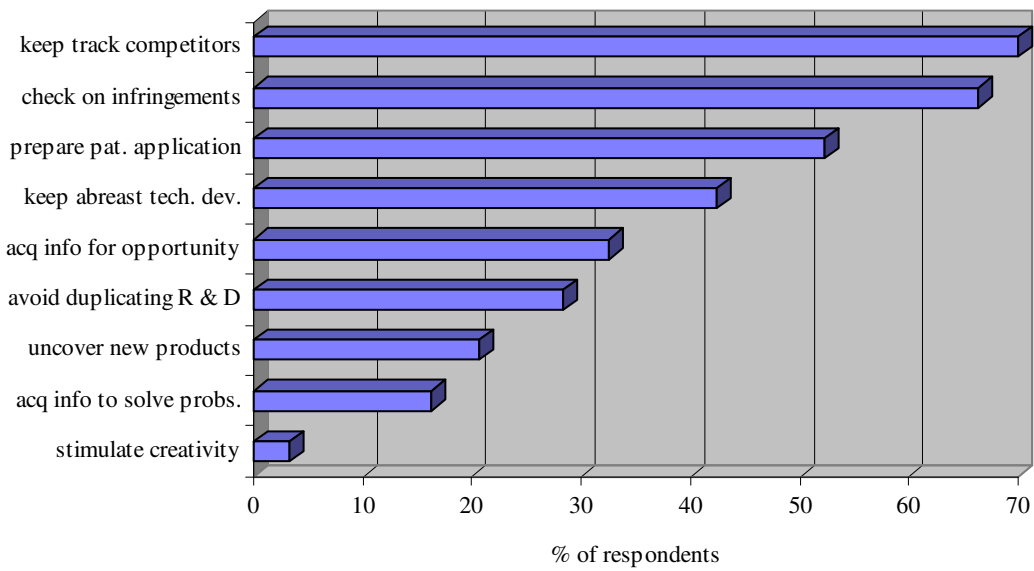


Figure 3b: Why Patent Searches are Conducted by Patenting Small Firms

