Introducing Inventiveness into the Patent System

Submission to the

Review of the

National Innovation System

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"It was never the object of those [patent] laws to grant a monopoly for every trifling device, … Such an indiscriminate creation of exclusive privileges tends rather to obstruct than to stimulate invention. It creates a class of speculative schemers …"

US Supreme Court (287 ref 107 US 192 (1882) Atlantic Works v Brady).

"Economists have known for some time that patents are not the only — or in most industries the most important—mechanism for preserving incentives for innovation. Ironically, this understanding was solidified at approximately the same time as the apparent importance of patents began to rise."

(Jaffe, 2000: 554)

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Declaration of interest

The Australian National University is a research and educational institution.

I have spent the past four years undertaking research into the economics of patent systems, focusing on the design of patent systems and whether these can be seen as having a positive or negative impact on national per capita income/product. This submission draws heavily on my PhD thesis which will be submitted for examination later this year.

My interest in the topic arises from earlier experience in the Australian Commonwealth Government, where I spent time as Assistant Secretary of the then Infrastructure Branch of the Department of the Prime Minister and Cabinet, and as Assistant Director in the then Bureau of Industry Economics (Department of Industry, Science and Technology). At the BIE I was responsible for research on innovation, for the Small Business Research Unit and for program evaluation. These experiences provided first-hand exposure to the extensive rent-seeking activities of many corporate actors. They also demonstrated the importance of an evidence based approach to policy, and to the power of the welfare framework in guiding decisions towards those that best represent the overall public interest.

Acronyms

ABARE	Australian Bureau of Agricultural and Resource Economics
ALRC	Australian Law Reform Commission
BIE	(Australian) Bureau of Industry Economics
CAFC	Court of Appeals for the Federal Circuit (the US court which hears all patent appeal cases)
EPO	European Patent Office
IPAC	(Australian) Industrial Property Advisory Committee
IPCRC	Intellectual Property and Competition Review Committee
R&D	research and development
TRIPS	(Agreement on) Trade Related Aspects of Intellectual Property Rights

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1. Innovation Diffusion and Economic Growth

The Department's call for submissions rightly draws attention to the need to consider both the generation and the diffusion of innovation. Given the small proportion of firms (and other organisations and individuals) generating genuinely new knowledge and ideas, it is inevitable that diffusion is the key driver of productivity growth.[1] This is based on simple arithmetic – where the bulk of the economy is involved with the adoption of innovations that are new to the firm or the industry, rather than to the country or the world, productivity improvements are driven principally by technology diffusion.

Despite the central importance of innovation diffusion to productivity growth and therefore to economic growth, the principal attention in national innovation policy is directed to the generation of new knowledge and ideas and their initial industrial application. The major Commonwealth Government initiatives to support innovation involve funding to public research bodies, encouragement of effective co-operation between research bodies and firms, and funding for corporate research and development activities. In addition, the government intervenes massively in the innovation market by providing legislated monopolies (patents) for "inventions". Commonwealth Government programs and policies to encourage the diffusion of technology are sparse.

To some extent this is because such programs fall more clearly within the ambit of State Government responsibility. Diffusion programs are often located under the heading "small business" rather than under "innovation". The Commonwealth Government has had specific programs to encourage diffusion – such as the National Teaching Company Scheme – but these are generally small compared to the resources devoted to innovation generation.

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1 As National Innovation Surveys show, only a small proportion of innovating firms are generating innovations which are new to the world or to the country. See, for example, Australian Bureau of Statistics, 2005.

The major Commonwealth Government policy affecting technology diffusion is in fact the patent system. While designed ostensibly to encourage the generation of inventions, the mechanism by which this is achieved is the suppression of technology diffusion. The patent monopoly is the grant of a right to exclude others from using a specified area of technology or knowledge application, whether independently developed or not.

2. Submission Outline

This submission raises some serious questions about the role of the patent system as it operates today. Because of the potential impact of the patent system on innovation diffusion, particularly on continuous and/or incremental innovation, this issue should be of central importance to the review of the national innovation system.

The submission draws heavily on my near-complete PhD thesis (Moir, forthcoming), but provides a far more condensed argument.[2] On the basis of empirical evidence about the inducement effect of the patent system, and the current very low inventiveness standard for patent grant, policy proposals are put forward to re-introduce inventiveness into the patent system, thus making it potentially welfare-enhancing. These proposed changes would also have a major impact in ameliorating the negative impact of the patent system on continuous/incremental innovation.

What is the role of patents in ensuring a return to investment in research and development (R&D)? Section 3 draws attention to the substantial empirical evidence that only in exceptional cases do patents induce innovation. Only where technologies are highly codified is there likely to be any failure in the innovation generation market.[3] In the general case, companies are well able to obtain a return on their R&D investment through market mechanisms, particularly first-mover advantages and complementary assets and capacities. On the basis of this evidence, most industrial innovations are not induced by the patent system. Even in very large markets, such as the USA, only a minority of patents are likely to be induced by the patent system.

To the extent that patents do induce innovations, it is the inventiveness of the innovation which gives rise to possible social benefits (externalities, mainly in the form of knowledge

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[2] The full draft document can be obtained from the author on request.

[3] There is also a strong *a priori* (theoretical) argument that where initial investments are large or lumpy, there may be a failure in the innovation generation market. This possibility was identified by Arrow (1962) and has been analysed more recently by Boldrin and Levine (2004).

spillovers) which may offset the costs of a patent system and thus give rise to a net economic benefit. Attention is thus turned to the balance in the patent system. This brief review focuses on changes in patent law, particularly with respect to the subject matter that can be patented, and to standards of inventiveness (Section 4). It provides a very condensed description of the changes to the patent system that have given rise to a situation where "anything under the sun invented by man" is patentable, with a deep gulf between the patent meaning of "obvious" and that in common use.

Section 5 briefly reviews the results of my empirical investigation of the inventiveness of recently granted Australian business method patents. Among these 72 patents there are no contributions to new knowledge or its application. As TRIPS, to which Australia is a signatory, requires no discrimination in patent law between technologies, there is a strong likelihood that in other technology fields Australia is readily granting patents for completely uninventive inventions. The analysis of these 72 cases raises a number of issues about administrative and doctrinal rules currently used in the granting of patents.

These three sets of data provide essential background and evidence for the main part of this submission (Section 6). This is a set of TRIPS-compliant proposals to re-introduce inventiveness into the patent system. They would have the effect of potentially re-focussing innovation resources on substantial innovations. At the same time they would reduce if not eliminate the impediments to an environment of continuous adoption and improvement of new technologies and methods of doing businesses. Businesses could focus on profit and growth rather than on avoiding legal complications due to monopoly grants to their competitors.

3. Do Patents Induce Innovation?

Given that patent policy is a prime example of regulatory intervention into the operation of the market, there should ideally be a substantial body of evidence that the intervention is welfare-enhancing. Despite suggestions from review bodies, such as IPAC (1984), there continues to be an almost total absence of evidence about the operation of the patent system.

It is generally *taken for granted* that patent laws are needed if a country is to have a high level of invention.[4] This conventional view has not been interrogated, despite the body of empirical work on industrial innovation whose results call it into question. Based on the evidence of increasingly large-scale surveys, repeated in many countries, and covering firms of all sizes and in all industry sectors, in most circumstances patents are the *least effective* of a number of mechanisms for ensuring a return to investment in industrial R&D. The general finding is that for firms of all sizes, and in almost all industries, most investment in industrial innovation would occur in a world without patents. Patent policy is thus not having the intended effect. In most circumstances it does not induce additional innovation activity—it simply provides a potential windfall gain for activity that would occur anyway. As there are costs generated by a patent system, the clear conclusion is that, in most circumstances patent policy is welfare-reducing not welfare enhancing. Its position as the default innovation policy choice can only be seen as irrational.

There are, however, some exceptions where patents are reported, by senior industry figures, to be essential as a mechanism to induce innovation investment. The principal circumstance is the narrow range of industries where the new knowledge embodied in innovations is highly codified (and thus relatively more easily copied), and where innovation investment costs are large and indivisible. The primary examples are the pharmaceutical and fine chemicals industries. Some commentators have argued that patent policy is precisely designed for the type of innovation system evident in these industries (Mandeville, 1996, Macdonald, 2004). For these few industries, patent policy may generate more benefits than costs, and so may be welfare-enhancing.

The empirical data provide a sound evidence base for selecting between competing economic theories that have been used in discussions on patent policy, thus placing policy debate on a more rational basis.[5] To date, much of the discussion on patent policy has been theoretical or opinion-based. Those in favour of strong patent systems draw on a narrow neo-classical framework to argue that, absent patents, the level of innovative activity would be socially sub-optimal. Those who are in favour of a weak patent system are more likely to draw on information economics to point out that the *key role of knowledge is as an input*

[4] This underlying assumption is clear in several recent reviews: IPCRC (2000), (US) Federal Trade Commission, 2003, (US) National Academy of Sciences, 2004, as well as in academic articles (e.g. Gans et al., 2004).

[5] This large empirical literature is discussed in detail in Moir, forthcoming.

into the production function, and that the costs of acquiring knowledge are high. They conclude that there are adequate market mechanisms to ensure a return to innovation generation, except where such innovation has a high component of codified knowledge. As a consequence, patents are unnecessary in most circumstances.

The empirical data that have been collected over the past thirty years provide a substantial evidence base for selecting between these competing theories. While the main evidence was initially from the USA, the findings have been replicated in a number of European studies, and re-confirmed through the findings of large National Innovation Surveys.

The initial study was by a group of Harvard Business School students interested in the impact of anti-trust decisions on patenting. This early study found that few companies considered patenting important in obtaining a return from R&D (Scherer et al., 1959). Taylor and Silberston (1973), in a study of British manufacturing firms found similar results: generally senior business figures did not consider patents to be important in ensuring a return to R&D investment. There was however a major exception: pharmaceutical and fine chemical firms. The findings of these studies were replicated, with larger samples, in the USA through the Yale survey in the 1980s and the Carnegie-Mellon survey a decade later (Levin et al., 1987, Cohen et al., 2000). These large-scale studies are supported by the results of smaller more intensive studies such as those undertaken by Mansfield and colleagues in the late 1970s and early 1980s (Mansfield et al., 1981, Mansfield 1986). Small-scale studies in other countries have found similar results (e.g. Harabi, 1995). Some of these studies directly address the issue of copying costs, and find that the costs of copying are far more substantial than assumed in the neo-classical theory.

Beyond these specific studies, data from National Innovation Surveys confirm that patents are generally seen as the *least* effective means of ensuring a return to innovation (see e.g. Eurostat, 2004, Australian Bureau of Statistics, 2005).

The data clearly demonstrate that except where innovation is highly codified, imitation costs are substantial and lead-time advantages and access to complementary assets operate to ensure a sufficient return to innovation. There is generally no failure in the innovation generation market.

The information economics approach provides a much sounder basis for the development of a welfare-enhancing patent policy: its assumptions are consistent with the empirical evidence across all industries. Its predictions are borne out by the facts. Where the codified element of knowledge is high, as in the pharmaceutical industry, copying will be relatively less expensive. But where the tacit component is high copying will be expensive, both in terms of time and resources, and the market provides adequate returns to innovation investment.

The clear conclusion from this evidence is that a welfare-enhancing patent policy would not apply across-the-board, but would rather be used only where it was effective in inducing additional innovation investment. Unfortunately the TRIPS Treaty makes this first-best option impossible without incurring the high cost of being excluded from the international free trade community.

Because of the absence of direct data on the operation of patent systems, the theoretical pro-patent literature has not only been sanguine about the level of alleged benefits of patent systems, but it has also tended to gloss over the costs. One major strand in this literature is the view that the static efficiency losses due to the operation of patent monopolies will be low because in most cases there will be substitute products or processes (Gans et al., 2004). This may well be true. It would be useful if there were data that could be brought to bear on the issue. But to the extent that it is true, it also suggests that patent policy is ineffective in inducing benefits. If a patentee has very little market power, then s/he cannot obtain the monopoly returns which are alleged to be the inducement mechanism. Either there are monopoly opportunities, acting as an inducement mechanism—in which case there are both benefits and costs. Or there are no monopoly opportunities, and so neither costs nor benefits, except for the direct transaction costs.

The absence of direct data on the impact of patented inventions is problematic. Commentators have suggested that the costs of a patent system are high (Cole, 2001), and increasing as patent systems are strengthened (Jaffe, 2000). Many patent offices have expressed concerns about the direct costs to patentees, especially smaller companies (for example, EPO, 1995). Of more concern from a welfare perspective are the possible costs in terms of negative impacts on subsequent innovation. There is an unfortunate gap in evidence on this matter, except for anecdotal evidence.[6] There is the opportunity to obtain

[6] And some important historical examples where technological development has been held up because of patents. The most often quoted are the steam engine (Sell and May, 2001), radio, and airplane stabilisation and steering (Merges and Nelson, 1990; Cohen, 2005). Cohen concludes that although the probability of such hold-ups might be small, the social cost if they occur can be very substantial.

such evidence through the large-scale innovation surveys which are now regularly carried out in many countries. These surveys provide an excellent opportunity to ask innovating firms about the impact of the patents owned by others on their own innovative investment. This would provide an evidence base for discussions of what is alleged to be one of the major costs of patent systems.

The essence of effective policy is that it achieves the intended outcome, at minimum unwanted cost. But patent policy does not appear to be effective in achieving the intended outcome—an increase in innovative activity—except in very narrowly circumscribed circumstances. Moir (forthcoming) estimates that only some three per cent of patented inventions granted in Australia are induced by the patent system and have the potential to generate the positive spillover benefits that would offset any costs imposed by the patent system. Other countries where the proportion of patents domestically owned is small would be in a similar situation. At the opposite end of the spectrum is the USA, where some 25 to 33 per cent of patented inventions may be induced and potentially generating positive externalities.[7] Thus in a country where a high proportion of patents are domestically owned, and where many foreign owned patents are domestically worked, a substantial minority of patents may generate benefits. For patent policy to be welfare-enhancing these benefits need to be greater than the costs imposed by the patent system as a whole.

A threshold question in assessing whether a patent policy is welfare enhancing or not is the level of inventiveness of the granted patents. It is the development of new products and processes which can potentially generate spillover benefits, both in the form of increased consumer surplus, and though knowledge spillovers. The more inventive the innovations, the greater such benefits are likely to be. If a patented invention is only very marginally different from previous artefacts, it is unlikely to generate much additional consumer

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[7] Essentially these estimates look at the proportion of patent grants by the country of residence of owners and by whether the invention falls into the pharmaceutical/fine chemical area or not. For small countries, such as Australia, the grant of an Australian patent to owners resident in very large markets is unlikely to be critical in the R&D investment decision. Thus for grants of Australian patents to G7 residents, no incentive effect is allowed. However for patents granted to owners resident outside the G7 groups of countries an incentive effect is assumed: 100 per cent of pharmaceutical/fine chemical inventions are assumed to be induced by the Australian patent system, and between 25 and 40 per cent of other technologies. The 25 to 40 per cent range is from Cohen et al., 2000, and is the estimated proportion of patents taken out for other than defensive reasons. For the USA, companies located in large overseas markets may still need protected access to the US market to gain a return on R&D investment. Canada is treated the same as the USA, with no diminution in the incentive effect of US patents, but for the other five G7 countries, estimated percentages of patents induced are halved – that is 50 percent of pharmaceuticals/fine chemicals are estimated as induced, and between 12.5 and 20 per cent of patents in other technology areas. For all smaller countries the incentive effect of a US patent is treated as if the owner were resident in the USA or Canada.

surplus. And if a patented invention does not contribute new knowledge, it cannot generate knowledge spillovers. The higher the threshold level of inventiveness required for a patent, the more likely there will be a high level of benefits attributable to a patent system.

4. A Short Review of Changes in the Patent System

There have been some remarkable changes in the patent system over the period since 1945, more particularly over the past three decades. These changes have seen a substantial broadening in the types of "inventions" that can be patented – firstly to life forms and software, and subsequently to methods of doing business. The end result is that nowadays there is no requirement for either a scientific or a technological basis for a patentable invention.[8] Christie (2000) concludes that in Australia today anything is patentable, provided that it is drafted in the form of a "useful" application.

As well as this broadening in patentable subject matter, there has been a significant reduction in the inventiveness requirement for obtaining a patent.[9] There is a substantial academic literature on the problems of uninventive, obvious or trivial patents. Lunney (2001, 2004) provides a substantial analysis of how recent court decisions in the USA have radically reduced the inventiveness standard for the grant of patents. Jaffe and Lerner (2004) provide some entertaining examples of obvious patents, in the context of a more serious analysis of the increasing dysfunctionality of the US patent system. Ullman (2000) demonstrates the role of the legal doctrine of a "person skilled in the art" in defining obviousness/inventiveness, while Bagley (2001) ably demonstrates that the narrowing in the definition of any particular field of technology ("art") has contributed substantially to the lowering of the inventiveness standard. This literature is based on the US patent system, and there seems to be widespread agreement that the US patent system has a very low standard for assessing obviousness (inventiveness). Dreyfuss (2000) comments on the large number of "shockingly mundane" patents that are being issued in the business method field.

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8 At least in Australia, the USA and New Zealand. The European Patent Convention still seems to require a basis in technology. A fuller discussion of how these changes came about can be found in Moir (forthcoming): chapter 3.

9 Lawyers consider that novelty and inventiveness are two separate tests for patentability, but from a policy perspective it is more useful to consider inventiveness as a continuum, with lack of inventiveness (not new) at one end of the scale, and radical inventiveness (new paradigms) at the other. There are also other requirements for patentability. Some are formalities. Utility is generally defined as a substantive rather than a formal requirement, but from a non-legal perspective this requirement has become so broad that it is unlikely that anything that can earn a dollar would be defined as lacking in utility.

In the one published empirical article which assesses the content of granted patents for inventiveness,[10] Campbell-Kelly and Valduriez (2005) use the (admittedly low) standards of the US Patent and Trade Mark Office (USPTO) to assess the 50 "best" granted software patents.[11] They find that all involve only incremental innovations, and that two are obvious.

These changes in patent policy have generally occurred through a series of judicial decisions, subsequently adopted into statutory law or regulations with no substantive policy debate.

What has happened to the balance in patent law?

The discussion of patent policy is dominated by lawyers, notwithstanding its clearly economic policy goals. Patent law has developed from a simple social contract—more innovation in exchange for temporary monopolies—into a complex and arcane set of rules, described in language closely related to that used in the 1624 *Statute of Monopolies*. The rule-complexity and archaic language have been used effectively to limit discussion of patent policy, not just to lawyers, but to members of the patent community (patent attorneys, patent office staff, and major users of the patent system, often represented by their in-house patent attorneys).

Patent law has changed considerably since the English parliament first codified Common Law limits to the right of a monarch to grant monopoly privileges. Section 6 of the *Statute of Monopolies* provided an exception to the limitations on such monarchical privileges. This exception was for inventions. Monopoly privileges could be granted for "any manner of new manufactures", provided these were "not contrary to the law or mischievous to the State, by raising prices of commodities at home or hurt of trade, or generally inconvenient." For some two hundred years patents of invention were granted only for physical artefacts. Then, in 1842, a patent was granted for a process for smelting iron, that involved no physical artefact. This judicial extension of patentable subject matter from artefacts to processes formed the basis for the subsequent extension of patents to computer software

10 There are a number of articles which purport to assess obviousness/inventiveness using proxy variables, such as the number of backward citations or the number of claims. There is no evidence that these are reasonable proxies for inventiveness. Dahlin and Behrens (2005) successfully use patent citation similarity scores, comparing patents in the set of tennis racquet patents, to identify the most radical inventions; but this is an asymmetrical measure and cannot be used in the inverse to identify obvious patents. Their work does however indicate that the simple citation measures are inadequate as a measure of inventiveness.

11 Using forward citations to identify the "best" patents, and reading the patent specifications to identify obviousness.

and business methods. This legally developed doctrine, that processes were patentable, was subsequently adopted into statutory law, apparently without any policy debate.

But processes raise far greater boundary problems for patent law than physical artefacts. Such difficulties are compounded in patent systems where a patentable invention is defined as a manner of manufacture, with reference to the *Statute of Monopolies*. In Australia the High Court determined, in 1959, that a manner of manufacture was effectively any "artificially created state of affairs" that had economic value. This is an extremely broad definition of what might be patentable. Christie considers that it means there are no subject matter limits to patentability in Australia, except those excluding human beings and the biological processes for their generation, which were written into the *Patents Act 1990* (Christie, 2000).

With the development of computers in the mid-twentieth century, there was an active policy debate as to whether patents should be extended to this new technology area. In the USA the 1966 President's Commission on the Patent System recommended that patentability not be extended to software, and in 1980 copyright protection was formally extended to cover computer programs (Samuelson et al., 1994; Smith and Mann, 2004). Subsequently the US government lobbied others to provide this form of protection for software. Its first success was in Japan, and in 1994 it succeeded in having copyright protection for computer programs made compulsory, as part of the TRIPS Treaty. The Australian history was similar (except for the influence on other countries). The 1984 IPAC review of patents considered the issue of computer programs, and concluded both that there was no need for patents to encourage software innovation and that implementing patent "protection" for software would raise substantial practical problems (IPAC, 1984). The government accepted these recommendations. In 1984 the Copyright Act was amended to formally extended copyright protection to computer programs (Bell, 1987).

Unfortunately the legal view appears to be that, if no limits are specifically written into a statute, then there are no limits, even if a government has considered the matter and reached a firm policy conclusion. This approach is most starkly illustrated by the 1980 US Supreme Court case, *Diamond v. Chakrabarty*. The government lawyer argued that the passage by Congress of two statutes specifically providing intellectual property 'protection' for plants was a clear indication that Congress considered that the *Patent Act 1953* did not apply to any form of life. Five Supreme Court judges disagreed, and in a 5-4 decision allowed the patenting of micro-organisms. This decision was highly influential in the 1981 *Diamond v Diehr* case which opened the doors to patenting software. During the subsequent years lawyers continually pushed the boundaries of this decision, and in 1998 the US Court of Appeals for the Federal Circuit determined that anything under the sun invented by man was patentable (Thomas, 1999, Freedman, 2000, Merges, 2003). This decision was effectively been adopted into Australian and New Zealand law. Even in Europe, where statute law specifically excludes the patenting of computer programs or business schemes as such, many patents are being granted for software and business methods, particularly by the European Patent Office (EPO) (Bakels and Hugenholtz, 2002).

Much of the doctrinal analysis and commentary on patents in general and business method patents in particular, suggests that there are good reasons to believe that the general standards of patent quality have fallen to a very low level. The story of how the "any manner of new manufactures" condition evolved into a novelty test against existing knowledge, considered only one item at a time, and an inventiveness test which considers that the use of a well-known method in a marginally different field is not obvious, is of considerable interest to policy analysts. The bottom line is that the Australian *Patents Act 1990* now has three tests to see if an "invention" is inventive enough to be granted a patent. These are the novelty test, the inventiveness test, and a third test to see if the invention is actually inventive enough to merit the term invention. This last test has been used to deny at least one patent to an "invention" that had passed both the novelty and inventiveness tests (Brennan and Christie, 1997).

This story of a series of doctrines developed through case law and gradually adopted into statute law without any further economic or policy analysis provides the context for understanding patent law as it operates today. It also explains the gulf in the meaning of the word obvious in terms of its normal meaning, and its meaning in patent law. There is a large commentary on the number of obvious patents being issued. But most of these meet the legal definition of "inventive". This raises serious questions about the state of balance in the patent system as it now operates. And, of course, it is the balance between the benefits conferred by a patent system and the costs incurred that determines whether a patent system is welfare-enhancing or not.

5. How inventive are currently granted patents?

Moir (forthcoming) provides an analysis of the inventiveness of 72 recently granted Australian business method patents. The study is based on an assessment of the content of each patent, particularly the claims. In this manner it is similar to the useful investigation of software patents by Campbell-Kelly and Valduriez, 2005. However Campbell-Kelly and Valduriez used the low current USPTO inventiveness standard as their test of inventiveness. Here a new approach is developed, based on the policy goals of inducing additional innovation and ensuring that the net social impact of the patent system is welfare-enhancing. The principal test used in assessing the recent patents is whether they contribute to knowledge, either in the technical field of software engineering, or in the non-technical field of business methods.

While data on the inventiveness of patents does not answer the question of the net social outcome of a patent system, it still advances the evidence basis for the debate. If most granted patents are inventive, then at least some social benefits can be anticipated. But if many granted patents are only marginally inventive, then any presumed benefits from the patent system will be much less, and may not offset the costs that patent systems impose. In such circumstances the patent system may be welfare-reducing rather than welfare-enhancing. Investigation of the inventiveness of patents thus provides critical information for the design of a balanced and welfare-enhancing patent policy.

Between 1 January 2003 and 31 December 2006 1,331 patent applications were filed in the business method classification in Australia.[12] By 30 June 2007 94 of these had been accepted or granted.[13] The resulting universe of 72 recently granted business method cases forms the dataset in Moir (forthcoming). Data were also obtained on whether these patents had been granted or rejected overseas, as at December 2007.

No contributions to either technical or non-technical knowledge are found among these 72 recently granted patents. One patent appears to use existing knowledge in a manner that

[12] The International Patent Classification system changed on 1 January 2006. Previously business method patents were allocated to class G06F 17/60. From 2006, business method patents were allocated to class G06Q, excluding sub-group G06Q 20/00. In identifying business method patents, all grants with an allocation to any of these classes were selected. Subsequently 21 of these patents were excluded as not being genuine business method patents. One Patent of Addition was also excluded as its great-grandparent was also in the dataset.

[13] Very few of these applications had been withdrawn. Over 90 per cent remained pending.

might be new.[14] Three others contribute new ideas,[15] but there appears to be no ingenuity required in their implementation. It is unclear that the owners of any of these patents would be able to demonstrate they were inventive if the onus of proof lay with the applicant.

While there are severe boundary problems, it is possible to classify the patents into three groups, based on the form the "inventiveness" takes. Some simply take a known method or process and combine this either with computers or with networks—19 of the patents fall into this group. Others make trivial variations to existing processes, or combine known processes—41 fall into this group. The last 12 seem to involve the simple specification of a 'problem', then the use of straightforward logic to generate a 'solution'. This latter set includes six betting patents, and a reverse mortgage finance patent.

Obviousness, analogous use and combinations

An early patent doctrine was that of analogous use—where the known properties of a material make it well-suited for use in a new situation, this was deemed obvious, and thus unpatentable. From a policy perspective, this seems an imminently sensible doctrine, as it prevents the grant of a legislated monopoly for something that is likely to generate no spillover benefits. Unfortunately this doctrine appears to have been over-ridden, at least in Australia, by a subsequent doctrine deeming that the combination of two or more elements is not obvious unless someone has already done exactly that, or has written down how to do exactly that.[16] But the obvious is rarely written down (Ullman, 2000).

The "inventions" involving mere computerisation or combining a known process with a network include examples such as computerisation of the standard method of performing property valuations, ordering ID cards over a network, checking if someone is home to take a delivery, a geared investment loan package, evaluating performance in business units, evaluating business risk, and implementing new software systems. Five of six patents which have been rejected overseas involve the mere computerisation of known methods. On the other, hand six of the 19 computerisation/network patents have already been granted patents overseas.

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[14] Converting dates to numeric format before calculating future events.

[15] Using biometrics as well as other information to track goods; stopping unwanted email at the server; and linking bar codes directly to website addresses. These ideas may be novel.

[16] While this is the Australian situation, similar patents are issuing in the USA, where the CAFC has changed the rules about demonstrating obviousness such that what appear obvious combinations to the ordinary person are deemed not obvious under patent law (Lunney, 2004).

Forty-one of the "inventions" either combine well-known methods or make trivial variations to well-known methods. In the worst cases, they involve the application of well-known techniques in narrow new fields, for example benchmarking or audit. Again one might expect that such "inventions" would be ruled uninventive on the basis of the analogous use doctrine. But, as indicated earlier, courts (and therefore the patent Office) seem to give precedence to a later doctrine which effectively allows the grant of a patent for any combination of elements which has not been patented before in exactly that form.

This doctrinal rule leads directly to an unbalanced patent system. Such a strong priority is being given to avoiding the risk of rejecting inventive inventions (type I errors) that very large numbers of patents are being granted for uninventive inventions (type II errors). The grant of invalid patents incurs high costs for the economy, through their impact on business and invention. While design of any policy involves trade-offs, there is general agreement that a low inventive step incurs high social costs, which are not offset by spillover benefits. In discussing this issue, and the design of patent policy, Jensen and Webster suggest that there will always be some errors (Jensen and Webster, 2004). Patent applicants have always been able to challenge rejection decisions. Recently courts seem to consider that it is not reasonable for an applicant to have to do this. Earlier legal judgements paid more attention to the social costs incurred through invalid patents. From a distributional perspective, it is an innocent party which bears much of the cost in challenging an invalid patent, while it is the party seeking a monopoly which bears the cost of challenging a patent office rejection.

There is a considerable asymmetry in the incentive to litigate a patent between the patent-holder and alleged infringers. Litigation costs are high, and the benefit of a decision that a patent is invalid is spread among many parties, not all of whom pay for the litigation. In contrast, where a patent is deemed valid (either through litigation or because no litigation takes place), the patent holder receives the full benefit. Because of these asymmetries, the likelihood that an invalid patent will be challenged is less than might be warranted from a public good perspective. This re-inforces the policy importance of a goal of minimising type II errors.

Existing knowledge problems

These 72 patent grants raise a number of issues about the rules used to determine inventiveness under patent law. Patent law presumes that there is a good, readily available, library of material demonstrating the current state of knowledge. But in software and business methods, much existing knowledge is not available in such a form. This practical difficulty was one reason that governments were advised not to extend patentability to software. The difficulty remains. One option is to exclude such fields from patentability. Another simple alternative would be to place the onus on the party seeking the monopoly to demonstrate inventiveness.

Related to this problem is the set of narrow prescriptive rules determining which pieces of knowledge can be used to determine either novelty or inventiveness. If it is an objective of patent policy to generate knowledge about new ways of doing things, then the body of existing knowledge used to test inventiveness or novelty should not be artificially narrowed. To narrow the body of existing knowledge is to tilt the playing field in favour of the applicant, and against the public interest. Statute law embodies doctrines developed through case law that limit the existing knowledge against which an alleged "invention" is measured. The most surreal of these rules is that previously patented inventions are not automatically considered part of the body of knowledge for the inventiveness test.

Courts now seem to be defining the relevant field of technology in a very narrow way. In respect of the US patent system, Bagley (2001) has demonstrated how technology fields are being so narrowly construed that most relevant prior knowledge is ruled inadmissible in the obviousness test. In a key Australian case, *Welcome Real Time*, the way in which the relevant field was construed, not as smartcard technology, but as loyalty programs, was critical to the decision of validity. Given the important policy goal that the social benefit of a patent system should exceed its cost (IPCRC, 2000), this judicial approach tends to unbalance the system. Like the doctrine that combinations should not be deemed obvious unless someone has said they are, this approach leans strongly in the direction of ensuring that patents are granted, regardless of whether there is a benefit to society. In part this is possible because the patent statute specifies no overall objectives.

Level of generality

Another major point emerging from the analysis is that some patents are written at such a high level of generality that there appears to be no difference between the idea and its implementation. Such cases, like the Signature patent at the heart of the *State Street Bank* case, effectively provide a monopoly on the idea.[17] The patents in the dataset considered here are mostly software applications, and are written in terms of such broad concepts as "calculating modules", "control means", "display means", "receiving device", "capture apparatus" and so on. In no cases are there any technical specifications, even where specific devices are used. This means that the patent specifications disclose little other than the general idea of the "invention". The lack of knowledge disclosure is not, however, a problem for this set of patents, as they contribute no new knowledge.

But the higher level of abstraction, the broader the scope of the claims. In a number of the cases examined it is clear that the "invention" has been developed in a specific environment (e.g. residential property valuation, processing insurance claims) but the scope claimed in the patent is for a much wider field (asset valuation, workflow prediction). While such claims are yet to be tested in court, they do pose risks for other businesses. And the broader the claim, the greater the risk, if the patent is held to be valid.

"Manner of manufacture"

Another issue emerging from this study is that the requirement for a specified output is so general as to be meaningless. Acceptable outputs such as "the repayment amount determined for the loan", or "generating a payment to each punter" mean that the manner of manufacture test has become totally ineffective in limiting the reach of the patent system. The requirement for a science or technology basis has been removed from the Australian patent system. The Australian Law Reform Commission has recommended review of this antiquated "manner of manufacture" concept (ALRC, 2004). This study indicates that such a review is not only urgent, but should also address the issue of whether a specific science and technology basis should be written into the definition of an invention in patent law.

6. Policy Implications

While in other fields there has been an increasing emphasis on the need for an evidence base to policy,[18] no such concerns have yet led to the development of appropriate databases from which to assess the real costs and benefits of patent systems.

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[17] In that case, a monopoly on computerised implementation of US Internal Revenue Service guidelines for pooled mutual funds in joint portfolios (Krause, 2000).

[18] The Cochrane Collaboration—to consolidate empirical evidence as a basis for determining the best approach to treating diseases—has been influential in the movement towards a demand for a stronger evidence basis for public policy beyond the health field. Information on the Cochrane Collaboration is available at http://cochrane.org (last access 28 January 2008).

There have been previous calls for the development of data on which patent policy decisions could be based. In Australia the IPAC review recommended that data on the use of patents be provided on each occasion when a patent was renewed (IPAC, 1984). This recommendation has never been implemented. More recently Bakels and Hugenholtz have called for the establishment of a European Patent Observatory (Bakels and Hugenholtz, 2002: 44). Again no action has been taken. In the specific field of the extension of patents to software and business methods, there have been several efforts to develop a knowledge base for use in policy determination in the USA. These have been stopped.[19]

Developing an evidence base

So the first need is for the establishment of effective data to measure the economic costs and benefits of patent systems. There are two obvious avenues for this. The first is to ensure that patent databases are re-oriented to meet public policy needs.[20] This means that patent data need to be accessible for economic analysis.[21] Further, when patents are renewed patentees should be required to provide information on how the patent is being used. This would not be an onerous task for patentees—a simple one-page pre-coded set of options could be provided. These data on how patents are being used would be invaluable information for assessing both the costs and the benefits of patent policy. They would provide a basis for establishing whether there are significant differences between different categories of patents in their costs and benefits.

The second avenue for collecting useful data on patents are the National Innovation Surveys that are now being undertaken in many countries, including Australia. Given the clear policy orientation of these surveys, it is surprising how little information they collect about patent use.[22] Mairesse and Mohnen (2003) note that the second (European)

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[19] In regard to data on the extension of patenting to software and business methods Kahin (2003) notes that "The White House Office of Science and Technology Policy commissioned a study on software patent quality and business effect by the Science and Technology Policy Institute at RAND in early 1998. However, it was suspended at the request of a U.S. multinational company concerned that the study would undercut efforts to secure greater international acceptance of software patents. The penultimate Senate draft of the American Inventors Protection Act of 1999 mandated a General Accounting Office study of business method patents, but this was removed at the behest of the patent bar. Despite calls by the 1999 National Research Council report, *Digital Dilemma*, for research on the effects of software patents, no studies have been commissioned, nor has the National Science Foundation supported any empirical research on the subject."

[20] At present they are designed to meet the needs of patent attorneys and patent applicants.

[21] This requires the ability to analyse patent data on the basis of multiple fields, with these being determined by the analyst. It also means that improved cross-classifications to industry must be developed, so that data can readily be matched to other economic information on the behaviour of firms.

[22] Or perhaps it is not. Perhaps innovation analysts are well aware that patents are of only very limited use in encouraging innovation, and hence do not waste space asking about them.

Community Innovation Survey (CIS2) asked no questions about mechanisms to protect innovation. The third survey (CIS3) asked whether patents and other formal (legal) or strategic (market) mechanisms were used, but did not ask about the relative importance or effectiveness attached to them.[23] These surveys are regularly undertaken, and are targeted at innovative firms—the exact target group for patent policy—so they provide an ideal opportunity for finding out a great deal more about the operations of patent systems. They could be used to collect data both on the forms in which patents are used by firms that own them, and on the impact of patents owned by other firms on the behaviour of innovating firms. These are currently major gaps in knowledge about the impact of patent systems.

Policy changes

Changes to patent policy should not wait until such databases are established and analysed. There is sufficient evidence already on the table to show that, for most industries, patents are ineffective policy. They have no effect in inducing additional innovation. The obvious solution is to restrict the fields for which patents are granted. This would create boundary problems, but these are implicit in any market regulation, and simply have to be dealt with. Previous boundary problems were eroded by the continuous extensions in software patenting, argued in court between private parties. The challenge and costs of boundary problems are not a reason for removing boundaries, though they might be a reason for removing market regulation. If there is to be market intervention, then it should be only where the benefits clearly exceed the costs. For patents, this means that patents should only be granted where innovations have a very high component of codified knowledge, and where development costs are high.

The simplest way to implement this boundary would be to establish which technologies can be patented and which cannot. This, however, would breach Article 27 of TRIPS, and any country contemplating this welfare-enhancing change to patent policy would face very high costs. An alternative would be to add codification proportions and development cost minima as new threshold tests for patentability. While far more complex and thus riskier (who knows what the courts would read into such limitations), this would be a TRIPS-compliant approach to limiting the scope of patents to those areas of innovation where patent policy is likely to enhance rather than reduce welfare.

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[23] The fact that much higher percentages of firms reported market mechanisms than patents does provide some indication of relative importance. See Eurostat, 2004: 290-298 for a copy of the CIS3 questionnaire.

Australia has not resiled from taking a leading international educational role where it considers policy approaches to be misguided and welfare-reducing. The pre-eminent example is with regard to the welfare losses consequent on agricultural protection, where ABARE prepared a series of materials directed at influencing overseas policy thinking. This educational investment is important in levelling the policy playing field where major vested interests are active lobbyists. There is a direct parallel with the "intellectual property" field. Substantial empirical evidence is available, and more could readily be collected. These data demonstrate that "strong" patent systems are likely to be welfare-reducing, even in large technology-exporting nations. Despite this evidence, the international policy community continues to place great weight on unsubstantiated assertions, such as a strong and direct relationship between patent protection and innovativeness. Academic authorities have expressed surprise at the continuing strength of the pro-patent lobby in the face of the evidence that patents are generally ineffective (Mazzoleni and Nelson, 1998, Scherer, 2006). Clearly a strong effort is needed to introduce an evidence basis into international patent policy discussions.

Subject matter exclusions

When TRIPS was agreed, in 1994, it was accepted that the most appropriate form of "protection" for software was copyright. Article 10 of the TRIPS Treaty requires that copyright "protection" be provided for computer software. It was commonly understood that computer software was not patentable, and the question of the patenting of business methods had not even been raised. It is therefore possible to exclude these fields from patentability without breaching the terms of the TRIPS Treaty.

With one exception, the 72 patents reviewed are all for computer programs.[24] Computer programs are, of course protected against copying by the *Copyright Act 1968*, amended in 1984 to include software programs. These "inventions" are therefore double-dipping in terms of "protection" against imitation.[25] Providing patent protection for software not only protects against copying, but it also prohibits independent creation. Where the "invention" is only trivially different from existing systems, such independent invention is highly likely. This increases the social cost of the monopoly grant.

[24] Though four also claim a monopoly over the manual version.

[25] Indeed with modern encryption methods, there could be three layers of "protection".

The policy question of the patentability of software is still an active issue, at least in Europe. The recent extension of patentable subject matter to business methods, makes serious policy attention to this question urgent. If software were excluded from patentability, the only "invention" from the dataset in Moir (forthcoming) that would have been granted a patent is the system for teaching children about the meaning of money by having them work for their pocket money.

In Australia a move to restrict patentable subject matter to inventions based on science and technology could usefully be combined with a review of the term "manner of manufacture". Such a review was strongly recommended by the Australian Law Reform Commission (2004). The review should be undertaken from an economic perspective, and should have as an over-arching goal the return of balance to the patent bargain. It should be undertaken by persons who are independent of the patent system,[26] and should include economists, industry policy analysts and representatives of the science and engineering communities, as well as consumer representatives.

Much of the discussion about the extension of patenting to business methods has been couched in terms of the issue being low inventiveness standards rather than a problem with subject matter extensions. Indeed Kahin asks whether it is useful to see business method patents as an issue in patent policy rather than patent administration (Kahin, 2003b). Certainly if software were excluded from patentability, or if a genuine knowledge contribution in a field of technology or science were required, almost none of these patents would have been granted. But it is equally true that if there was a genuine inventive step threshold, requiring at least a modest contribution to new knowledge, and comparing this to all previously existing knowledge, almost none of these patents would have been granted. So this study suggests that *both* subject matter extensions and other critical design features of patent law and administration are important issues in innovation policy.

A genuine inventive step

This study has noted the wide body of expert opinion in the USA that suggests the standard of inventiveness required in US patent law is extremely low. Bakels and Hugenholtz (2002) argue cogently that the current very low inventiveness standard in Europe is based on standards introduced through case law and legal doctrine. Moir (forthcoming) shows

[26] Members of the patent community would, of course, be free to present their views through evidence and submissions.

that the inventiveness standard in Australia is equally miniscule. Moir also shows that the low standard has been developed through a series of legal doctrines, based on individual cases. Together these doctrines so constrain the meaning of inventiveness in patent law, that it is virtually non-existent.

Because these low standards have developed through case law, they can only be reversed by amending the relevant statutes. Legislative change is required. This view is echoed by Bakels and Hugenholtz (2002: 37). In this they part company from many other commentators who recommend a range of administrative changes within patent offices. But it is clear that it is legal doctrine that is increasingly sloping the patent playing field in the interests of patent applicants, in a manner that significantly reduces economic welfare. Changing patent office practices will not change the attitude of judges, who are entirely independent. It will simply result in judges telling patent offices to adopt different procedures. The only available mechanism for raising the inventiveness standard is legislative change. In Australia there have been two very minor changes to statute law to attempt to raise the inventiveness threshold (1990, 2001), but these moves fall far short of what is needed. As long a most existing knowledge is ruled out of court for the purposes of assessing the novelty or inventiveness of a patent application, the standard for the grant of patents will be low, and there will be many patents granted that provide no spillover benefits to offset the costs they create.

Using market regulation disciplines to enhance welfare

Beyond these specific changes to legal doctrines, patent law could usefully draw on the general approaches used for ensuring that market regulations are welfare-enhancing. These approaches would be of great assistance in ensuring that patents were only granted for inventions that were likely to contribute spillover benefits, thus offsetting the social costs created by the patent system.

Onus of proof

The *legislative presumptions of novelty and inventiveness* mean that it is the government which has to show that a patent application is uninventive, rather than the applicant showing that it is inventive. Attorneys actively use of this rule in arguing for grant of a patent. There is no logical or evidence-based reason for this reversal of proof within the patent system. The normal regulatory rule is that the onus lies with the party seeking intervention in the market to prove, beyond reasonable doubt, that such intervention would be welfare-enhancing. If this normal rule were adopted, it is likely that most of the uninventive "inventions" reviewed in this study would not have been granted a patent. Others have also suggested that the onus of proof should be made consistent with normal regulatory norms. Such a policy change would be TRIPS-compliant.[27]

Standard of proof

The norm in most cases of regulatory intervention is that the benefit of regulatory intervention must be *significantly greater* than the harm. Due to the dominance of the legal approach in patent policy discussions such an option was dismissed by the IPCRC as being inappropriate for a civil matter (IPCRC, 2000). But patent policy is a tool of economic policy. The appropriate standard for regulatory intervention in the market is that the benefit be significantly greater than the harm. The appropriate decision-making standard in patent policy is therefore *beyond reasonable doubt*. This decision-making rule should be adopted for all aspects of patent policy and should be clearly written into the statute.

Patent policy goals

Issues about the onus of proof and the standard of proof are closely related to the policy goal that, overall, patent policy should be welfare-enhancing. That is, the social benefits arising from the policy should be greater than the social costs incurred. This question of balance has been a feature of patent policy since the exception to the limitation on monarchical monopoly privileges was first created in 1624. But it is not written into the statute. Indeed the purpose of patent policy is not written into the statute. It is time it was. This would give judges the guidance they clearly need in interpreting the statute in a manner that is welfare-enhancing rather than welfare-reducing. The patent statute should include a statement that the goal of patent policy is to increase investment in technological invention and innovation, in such a way that the overall benefit to society is greater than the overall cost. This could be complemented by a statutory requirement to administer the statute in a manner to minimise type II errors (granting invalid patents).

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[27] Extraordinarily, the TRIPS Treaty includes an Article requiring that the normal judicial burden of proof be reversed in the case of process patents. Article 34 sets out circumstances where a product shall be deemed to have been produced using a patented process unless the alleged infringer (the accused) proves otherwise (http://www.wto.org/english/docs_e/legal_e/27-trips_01_e.htm (accessed 30 April 2008)). However Article 34 applies only to litigation about infringement of a granted patent. Nothing in the TRIPS Treaty prevents an administrative requirement that applicants for patents be required to demonstrate that their inventions meet the statutory requirements of novelty, utility and inventiveness.

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