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Published in:
Intellectual Property Forum

March 2002

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This article focuses on the relationship between *intellectual property* and *intellectual capital.* The broader concept of 'intellectual capital' is a useful framework within which to analyse the relative merits and drawbacks of reliance on proprietary rights over knowledge. Strategic analysis of the costs, risks and benefits of various forms of proprietary protection is vital in the context of rapid innovation in a 'knowledge economy'. Maximising the value of the intellectual capital of the firm will require: a considered assessment of the strengths and weaknesses of each IP regime; combining reliance on the rules of intellectual property law with other strategies; and re-evaluating the utility, function and expectations of intellectual property protection in general. This article presents some tentative conclusions concerning strategies to protect the *intellectual capital* of the innovative firm. Its main themes are: (i) That intellectual property will not be effective in protecting many aspects of intellectual capital; (ii) That combining reliance on the rules of IP law with other strategies will maximise the firm's control over intellectual capital; (iii) That the real value of intellectual property rights may lie rather in their transactional utility than in restricting competition-by-imitation; (iv) That there may be advantages in investing in goodwill, rather than technological innovation and ideas; and (v) That a firm should primarily focus its *intellectual capital* strategies on maximising the value of the tacit knowledge of its employees.

Intellectual Capital

Introduction

The concept 'intellectual capital' is no longer new. Intellectual capital is more than just *intellectual property*. Intellectual capital consists of *all* the intangible assets of the firm, whether or not they are the subject of exclusive legal rights, and whether or not they appear on the balance sheet[1]. Arguably most intellectual capital does *not* appear as intangible assets (eg as trade marks, patents, copyright etc.) on the balance sheet[2]. For instance, general knowledge, skill and experience of employees, organisational culture, organisational structures, learning ability, and technological leadership are components of the intellectual capital of the firm that are not, or only marginally, covered by intellectual property rights (IPR's), and do not normally figure on balance sheets[3].

The concept 'intellectual capital' is not only a management tool, but also provides a useful framework for legal analysis. It places intellectual property in the context of the totality of the firm's intellectual assets, and focuses a lawyer's mind on broader strategic issues in the use and deployment of IPR's.

Information and knowledge.

Intellectual capital consists of knowledge or information[4]. Are there relevant differences between the two? It may be that knowledge is simply one subcategory of information; however, I make a *qualitative* distinction here, and view information as static, whereas knowledge is dynamic[5]. Knowledge is information in action, information understood and put to use. The term knowledge implies a connection between information and a *constant process of learning*, and is thus associated with novelty, originality, innovation, and progression in terms of what is known and understood[6]. Knowledge is the ability to acquire and deal with information in an effective goal-oriented manner. Knowledge is more valuable to the firm than mere information. At the very least, a firm needs to optimise acquisition of information *and* knowledge to compete effectively.

Tacit and codified knowledge

For a firm, knowledge can be usefully characterised

as either 'tacit', if it is contained in the minds of employee's; or 'explicit' if it is 'codified', ie expressed in some record from which it can be retrieved. Although codified knowledge is valuable because it can be inventoried and shared between members of the firm, it usually requires interpretation and understanding to be turned to account. Therefore, in an innovation driven economy, although knowledge can be externalized and recorded, it can rarely be efficiently traded separately from people.

An analogous distinction can be made between structural and human capital: human capital *is* the employees; structural capital is what remains behind when all employees go home[7]. Structural *intellectual* capital includes databases, precedents, structures, manuals, training materials etc. Structural capital is usually owned by the firm, and is transferred by the firm, whereas human capital is most commonly transferred in the mind of the individual employee, outside the control of the firm.

Appropriation and transfer of tacit knowledge

The fact that a large proportion of useful knowledge is tacit knowledge, ie human capital, has important implications in terms of the intellectual capital strategy of the firm. Codified knowledge is more susceptible to appropriation, control and structured acquisition or disposition by the firm; it is more easily converted into *intellectual property,* even though not all codified knowledge is potentially covered by IPR's. By contrast, as tacit knowledge is contained within the minds of employees, it is as mobile and as uncontrollable as the employees themselves, and largely outside the province of intellectual property law[8].

That part of human capital that is not subject to codification and to the constraints of intellectual property law, is only *'of the firm'* in a transitory and relative sense. Rules relating to acquisition and control of tacit knowledge are mostly within the domain of labour law, which largely determines the rights of employees in terms of terminating employment, entering into new labour arrangements or setting up competing businesses. In other words, *labour markets, not knowledge markets* determines the mobility and transfer of tacit knowledge.

The Knowledge Economy

Characteristics

The 'knowledge economy' is a ubiquitous concept rarely defined[9]. It is often proffered as the third stage of economic development, following on from agricultural and industrial stages. A knowledge economy is characterised by a huge discrepancy between the cost of inputs of labour, capital, energy and raw materials, and the value of industrial output[10]. In other words, it supports productivity growth despite static or declining inputs of manpower and other resources.

In terms of the firm, knowledge accounts for a large and increasing proportion of the price differential that it can command for its goods and services, and the difference between the realisable value of assets and stock value. A useful way of thinking about the difference between a knowledge economy and an industrial economy is to compare value and weight of goods: over the duration of the 20th century, the value of goods for a constant weight has increased exponentially. The additional value is the result of the knowledge contents of the goods; it is not the result of scarcity since the growth outstrips the expansion of overall inputs of goods and services[11]. Evolution from an industrial to a knowledge economy characteristically means a transition from physical to intellectual capital.

Knowledge markets

In a knowledge-based market economy knowledge production is increasingly a market function: *firms*, as well as public institutions, invest considerable resources in the production of new knowledge and information[12]. The rate and direction of production of knowledge is largely determined by the market rather than by external factors[13]. Knowledge accumulation is driven by profit motives rather than advancement of the public interest. As a consequence there is also an intensification of activity in expanding knowledge markets – the value of exchange increases rapidly. Although much knowledge is at present still produced in a 'public domain' environment, ie not subject to proprietary control, the knowledge economy is characterised by an expansion of knowledge subject to appropriation by way of intellectual property rights.

Appropriation of knowledge

As the knowledge market expands, and private investment in knowledge assets grows, pressure on regulators to shift more knowledge from the public to the private domain rises. In terms of law, there results a trend towards *extending* the reach of proprietary rights over knowledge. This trend is often criticised because the resulting contraction of the public domain may have a negative impact on productivity, by driving up the cost of knowledge and the transaction costs of knowledge acquisition.

Recently, certain patents in the field of biotechnology and genetics, and the supposed trend to allow business method patents have been the focus of such criticism[14].

Increased proprietisation of knowledge drives up the cost of learning. Privatisation of education (ie moving educational resources from the public to the private sphere) combined with a tendency to assert proprietary rights over knowledge produced in educational institution, have further cost and organisational implications for the innovative firm[15].

Technological innovation in the knowledge economy

Technology and technological innovation lie at the heart of the knowledge economy. Certain technological trends reflect the transition from an industrial to a knowledge economy. First, increased complexity: products consist of more individual components, reflecting more complex technological parameters. Secondly, products have a higher knowledge content, ie are ultimately based on and developed from theoretical insight and scientific experiment, rather than from practical experience[16]. Thirdly, families of technologies often have a common generic science base with multiple and varied applications that develop over time within measurable parameters[17]. Fourthly, technological products are more interdependent, ie various technologies inter-operate in a complimentary fashion. Fifthly, technology has a much shorter redundancy/innovation cycle and shorter product life cycle.

As a consequence, technological change becomes a matter of collaboration rather than individual effort: most inventions are made by collaboration between individuals or organisations, rather than by single individuals or isolated entities. Increased technological complexity inevitably results in increased organisational complexity, through a process of organisational innovation that matches and enables technological change. In terms of law, the knowledge economy is typified, therefore, by expansion in the scope and complexity of both intellectual property rights and contractually defined collaborative organisational structures.

Acquisition and dissemination of knowledge

In conditions of greater technological complexity, shorter innovation cycles, greater knowledge content etc. firms must develop a capacity both to acquire and to disseminate knowledge rapidly. A firm acquires knowledge in a number of ways. It can be developed in-house, for instance by investment in R&D. It may be acquired *as such* externally (eg in the form of intellectual property), or by acquisition of other firms, or by imitation. It may also be acquired externally by hiring employees with the requisite knowledge; or it may be bought in as training and consultancy services.

There is little doubt that most efficient knowledge acquisition occurs by way of learning, rather than structured acquisition. In the knowledge economy, firms as producers or acquirers of knowledge must be *learning organisations*; as suppliers of products and services they are *teaching organisations*. Both learning and teaching are constant functions of the firm in the knowledge economy. In terms of the law, learning and teaching result predominantly in the growth of human rather than physical capital. Much of the process of learning and teaching is a form of information exchange that are not structured on the basis of any kind of legal rules.

Knowledge management and intellectual property rights

For the individual firm, survival in a knowledge economy requires efficient acquisition and management of knowledge and information. These are critical to the firm's competitiveness even in a 'traditional' sector. Organisational innovation will be primarily aimed at devising more effective ways of obtaining, controlling and managing information[18]. A number of environmental determinants as well as organisational culture will influence the knowledge management strategy of the firm [19].

One of the firm's most important tools for the management of knowledge is intellectual property law. But efficiently managing IPR's alone does not equate to managing intellectual capital, which requires integrated strategies derived from an understanding of technology, of the market conditions within which a firm operates, and of the limitations of intellectual property law. It requires an understanding of alternative, non-proprietary strategies for controlling and extracting maximum value from intellectual capital as a whole: ie an integrated and 'holistic' approach.

Knowledge Networks[20]

Public and private sector networks

Technological progress no longer relies exclusively on gradual improvement through learning by doing, but on interpretation and exchange of complex scientific knowledge in the development of practical applications. Whereas scientific knowledge is still produced in large measure in the public sector

(universities and government research establishments), private sector investment in science has grown over time; more recently, so has public sector interest in proprietary rights. Previously the production of basic knowledge was largely separated from the application of that knowledge, paralleling a relatively rigid separation between public and private sector R&D. Now the two stages are increasingly integrated.

Indeed, contemporary innovation policy focuses almost exclusively on fostering efficient integration of the various stages of innovation, recognising that the traditional linear model of innovation is flawed. As a result, the production of knowledge has become a more market-driven activity, rather than one purely directed at education and the advancement of the public interest, which coincidentally impacts on markets. Much of the change has come about because of shifts in public and government attitudes to public funding of research, and increasing emphasis on the production of proprietary knowledge within universities and public research establishments. Overall, science and Academe, and innovation and commerce have become more closely integrated within various legal and organisational models. These arrangements are often complex and constantly mutating, requiring efficient collaboration and knowledge sharing within broad 'knowledge networks'.

Access to proprietary knowledge inventories
Given the wealth of available knowledge, the speed and diversity of its production, and the technological complexity and interdependence of products, no single firm controls all knowledge resources that it needs. Firms require access to each other's inventories of *proprietary knowledge*, and to proprietary knowledge held by publicly funded institutions. Firms are *interdependent* as far as both tacit and codified knowledge are concerned.

As the perceived value of knowledge mounts, attempts to appropriate knowledge grow more determined. Almost inevitably more knowledge becomes subject to intellectual property law, and what rights already exist are exercised more aggressively. Thus, at the very least, firms will require strategies which grant access to and use of a number of other firms' intellectual property resources.

But arms-length acquisition of codified knowledge is often of limited effectiveness. More productive is first, access to both codified *and tacit* knowledge; and secondly, *continuous* access to knowledge that is *constantly and rapidly evolving*. Thus a knowledge economy is marked by the search for access to proprietary knowledge through the creation of relationships which congeal into networks of interdependency.

At the same time, empirical evidence shows that there is a trend towards diversification and decentralization of research and development activity[21]. This trend gives rise to new forms of 'loose consolidation', although consolidation into single corporate units by way of acquisitions is still common. Start-ups, spin-offs, Cooperative Research Centres, joint ventures, outsourcing, private-public sector arrangements such as sponsorships and grants, etc proliferate in this market. Such trends reflect a need for co-operation that goes beyond hands-off acquisition of technology, while respecting the diverse and serendipitous pursuit that is R&D, and the dynamic nature of knowledge.

Discrepancy between products and intellectual property rights
When technological sophistication advances, increased complexity and versatility of products results. There follows a discrepancy between intellectual property rights and products. In other words, rarely does a single intellectual property right cover a single product, and as a result a number of intellectual property owners will have a stake in any given product[22]. IPR's, such as patents, play an increasingly important role in structuring essential transactions between disparate knowledge proprietors in the production of complex products[23].

Complex technologies with simple interfaces
The increased 'scientific content' and complexity of products, and the ubiquity of mass-market technology result in a difficulty for the innovator: how to make inherently complex products usable to the average person without specialist knowledge or experience. The problem is solved by producing simple and uniform interfaces between man and machine. This results in technological convergence: one interface and a single learning process gives a consumer access to a multiplicity of products from different suppliers. The problem is also solved by binding customer to supplier by a process of constant learning and support.

The knowledge economy thus generates greater dependency and integration between customer and supplier, as well as dependency between suppliers[24]. Communities of learning grow around technologies, both of producers and suppliers and of producers and customers.

Network economic effects

Recent scholarship has attempted to draw conclusions concerning intellectual property law from 'network economics'[25]. For our purposes, the basic tenet of the latter is that as the number of users of a technology increases, so does the value of the technology to each user[26]. At the same time, according to static economic theory, the more units of the technology produced, the lower production costs per unit are. As the cost to the supplier of the technology *decreases*, the value to the consumer *increases*. Thus proprietary technologies that enjoy network effects tempt the proprietor to raise the level of monopoly rents (ie price/unit), inflating profit levels because of lower per-unit costs. As the installed base of a technology grows, so should its price, at least where competitors can be denied because of IPR's.

Networks also tend to be 'sticky', ie there is often a considerable cost attached to a consumer extracting herself from a network based on a certain technology (eg learning, new investment, uncertainties about compatibility, transfer of data, of addresses etc.)[27]. In other words, first movers create a valuable commodity: dependency.

For the knowledge based firm network economic effects and 'stickiness' mean that material first-mover advantages will often result in pricing strategies with initial low returns[28]. There is an obvious correlation between material first-mover advantages and the structure of intellectual property law, because the grant of property rights is usually tied to the novelty or originality of the product or work. This is at once the purpose and the curse of IPR's: additional rents for innovators risk becoming excessive rents because they are compounded by structural first-mover advantages.

What is important in this context is that there is a concomitant risk of rival technologies being entirely frozen out of the marketplace, irrespective of their substantive merits. To avoid this risk, firms must be in a position to negotiate access on competitive terms, either by collaborating on the development of standard-setting technology, or by positioning themselves to bargain effectively on the basis of their own indispensable knowledge inventory.

Interim conclusions: intellectual property & intellectual capital in a knowledge economy

Three points result from the above. First, the limited reach of intellectual property law in relation to intellectual capital as a whole, requires a firm to develop a strategy that incorporates both reliance on IPR's and elements that do not rely on proprietary rights. Secondly, the predominance of tacit knowledge within intellectual capital as a whole requires a firm to focus primarily on efficient practices in hiring and retaining knowledge-rich employees. In this process intellectual property law plays only a minor role. And thirdly, the importance of effective participation in knowledge networks focuses attention on the transactional utility of intellectual property rights, rather than there value in terms of interdicting imitation.

The limitations of IPR's already referred to above are analysed further below first. Then some broad strategic options that flow from the three points here made are put forward.

The Limitations of Intellectual Property Law

Generally

It is indisputable that the importance of intellectual property rises in a knowledge economy. Yet intellectual property is only concerned with a fraction of all knowledge, and is not even all that effective in controlling that fraction. Hence the market for intellectual capital can not be equated with the market for intellectual property.

Furthermore, in a networked and interdependent knowledge economy the primary function of intellectual property law changes. From interdiction, it becomes cooperation. In other words, the main focus shifts from IPR's as combative rights that exclude, prohibit or interdict access to knowledge, to IPR's as transactional tools. It is in this light that in the following paragraphs I consider the limitations of intellectual property rights and the changing role of intellectual property law in the knowledge economy.

Tacit knowledge and intellectual property law

Compared to the intellectual capital of the firm as a whole, the scope and extent of intellectual property coverage is quite limited. I have already pointed out that much intellectual capital consists of tacit knowledge that is retained in the minds of employees. Such knowledge is only marginally affected by the rules of intellectual property law, because there is often little by way of IP law that an employer can do to exercise effective control over knowledge acquired on the job. The courts tend to favor the employee's freedom of employment over the employer's interests in controlling allegedly proprietary knowledge[29]. In other words, knowledge diffusion in a knowledge economy is to a considerable extent regulated by labour markets and labour law. It is also a matter of contract law, ie the formation of new legal constructs that allow access

to tacit knowledge on an ongoing, hands-on basis[30].

Limited scope and extent: patchy coverage
Intellectual property law also does not cover *general* knowledge, learning, know-how or experience; only very specific and clearly identified knowledge falls within its embrace. Thus there are no patents in discoveries or laws of science and the like, but only in specific applications of such knowledge. Copyright does not extend to the ideas expressed in a work. Trade secrets protection only extends to information specific enough to be demonstrably not in the public domain.

And rights run out over time. However, trade marks and other forms of protection for goodwill do not run out unless the owner of the right lets this happen[31]. For that reason alone, such rights over reputation have potentially greater future value, a point to which I return to below. But even a trade mark monopoly is subject to many restrictions, limitations and exceptions: the owner's control over a mark is not absolute. In general terms, the specificity of IP rights means that certain competitive/imitative practices fall through the cracks between the different regimes. Intellectual property protection will always remain patchy, because the law aims to strike a balance between effective incentive and the public interest in free or low cost access to knowledge and information.

Local rights in a global economy
Knowledge as a tradeable commodity lends itself to the geographical expansion of trade, since cost and complexity of distribution are minimal in relation to the value of knowledge. In a world with relatively homogenous levels of education, similar legal systems, a common linguistic base, and common communication platforms knowledge can be readily exchanged. Reduced costs of travel, transport and communication ease the way for a global trade in knowledge and in knowledge based goods and services. Students, teachers and manpower in general become mobile, constituting the principle mode of knowledge distribution. Knowledge about technology tends to be universally valued, whereas the value of other knowledge (eg about cultural rites) tends to be more location-specific. Technology tends to have universal appeal and thus value in any national marketplace in which the requisite technical and institutional conditions apply.

That the knowledge economy is global is reflected in the determination and enforcement of higher universal standards of legal protection for intellectual property[32]. Nonetheless, at present the detailed regulation of intellectual property is still a largely domestic matter, which creates difficulties for the knowledge based firm which trades across borders.

Although there are global treaty systems relating to intellectual property law and to intellectual property law and trade (TRIPS/WTO), IPR's are in fact still local[33]. In some trading blocks there is a slow move towards multilateral forms of protection (eg the European Patent Convention), but in effect the treaties leave governments quite free to regulate intellectual property law within flexible boundaries.

Copyright, because it does not depend on registration, is the most universal form of protection, by way of the Berne Convention – but even then enforcement will be in accordance with local rules in any other member country. Legal rules, and courts and officers enforcing those rules may be less than sympathetic to foreign intellectual property owners in some jurisdictions[34]. Relying on local law in a foreign jurisdiction may be ineffective, expensive and risky. The registration systems, ie patents, designs and trade marks protection, are local and restricted to a single jurisdiction[35]. Multiple applications are required, for multiple jurisdictions, with uneven effects. Thus although the knowledge economy is global, proprietary protection is uneven and not seamless.

The expense of intellectual property
Which brings me to my next point: the expense of effective intellectual property protection in a global economy. In a global economy it will be necessary to invest similar amounts in a number of jurisdictions, with spiraling costs. That is even before any expense of enforcing the patent (ie going to court or just hiring lawyers to advise) is taken into account[36]. Patents are certainly the most expensive form of intellectual property protection, but there are not insignificant costs attached to other regimes as well.

The real expense is even greater if one takes into account the uncertainties and therefore risks inherent in the process of applying for, obtaining and enforcing intellectual property rights in any jurisdiction. Intellectual property rules tend to follow slowly upon new technological developments, resulting in periods of adjustment and uncertainty precisely in relation to the most valuable technologies. Application of the law is unpredictable even within an IPR owner's home jurisdiction, let alone in foreign jurisdictions where competitors may

have competing vested interests in similar IPR's (eg the problem of local goodwill in a foreign trade mark).

Proprietary rights and publicity

The most important form of intellectual property in the context of innovation also has the drawback of publicity. Patents grant is dependent on an enabling disclosure: obtaining the monopoly requires divulging to competitors the nature of your knowledge in detail. A dilemma faces the firm: to choose secrecy without monopoly or monopoly without secrecy[37]? Reliance on trade secrets law may have limited utility because of the ease of reverse-engineering once the product is sold; trade secrets law does not normally prohibit reverse-engineering as such[38]. Trade secrets law also has the drawback that although damages or a temporary restraint may be available as a remedy for illegal disclosure, information irretrievably looses much of its value once it is in the public domain. Legal remedies can hardly ever fully restore the proprietor to his previous position, since he loses the advantage of secrecy not only in relation to the infringer but in relation to the world at large.

On the other hand, although patent grant results in a monopoly right, statutory publication may serve competitors in all sorts of ways. A patent flags the research path the applicant has chosen; it flags the nature of the technology and may suggest ways of invention around; and it may mean that another person obtains an improvement patent related to the invention, leaving a cross-licensing dilemma. A patent may well present an important technological breakthrough, but it is frequently only the gradual improvements that occur subsequently that result in a marketable and profitable product. Thus there will commonly be plenty of time for a competitor to position itself to absorb the market impact of the new product, and deny the patentee much of its potential competitive advantage. Competitors will not infringe IPR's, they'll simply use them as a stepping stone to overtake the patentee in the race to innovate.

Validity of granted rights is limited

Intellectual property rights that are granted on the basis of a process of examination are not necessarily valid, eg a grant of a patent is no guarantee of validity. There are 'weak' and 'strong' patents, ie patents whose validity is doubtful and others that more clearly conform to statutory requirements (eg novelty and inventiveness). The strongest patents may well be those that have been litigated and found valid on a counterclaim for invalidity, but this is a small category indeed.

However, it is probably the case that in an age of high litigation costs, a weak patent is just as effective a barrier to entry as a strong patent[39]. The cost of proving the invalidity of an apparently weak patent may be prohibitive. For the patentee, the fact that a granted patent is not necessarily valid means that there are hidden, uncertain and deferred costs attached to the process of patent grant and proof of validity. Litigating on the basis of a patent also risks destroying what apparent value a patent has if the result is a successful counterclaim for invalidity[40].

Interim conclusions: worry about innovation, not imitation

So a tentative conclusion may be that in terms of stopping imitation, and on a wider front, protecting the intellectual capital of a firm, intellectual property is only marginally efficient. In any case, I would suggest that a competitive firm should be concerned by a competitor's *innovation* rather than *imitation*[41]! Effective innovation by other firms is likely to affect competitiveness far more in the long run.

Because IPR's are costly, uncertain and difficult to enforce, of limited scope, easily subverted, and often function as a springboard rather than a deterrent for the firm's competitors, a firm should focus primarily on how to limit the impact of a competitor's *innovation*, rather than of a competitor's *imitation*. The lesson is simply; to use a hackneyed slogan: 'you've got to be in it to win it'. In other words, focus on IPR's as effective bargaining tools to obtain relevant knowledge and skills in the race to innovate. To put it differently, IPR's main value in a networked knowledge economy lies in their *utility as transactional tools.*

Intellectual Capital Strategies

From the above various broad strategic imperatives emerge for the innovative firm intent on maximising the value of its intellectual capital. To reiterate these: first, appropriate emphasis is required on the bargaining rather than barring uses of intellectual property rights, ie their transactional utility. Secondly, a firm should develop a broad and integrated strategy combining reliance on IPR's with other complementary strategies, and weighing up the strengths and weaknesses of various regimes. Thirdly, a careful choice must be made between investment in the development of alternative

intellectual assets; in particular, the advantages of investment in the protection of goodwill over investing in substantive innovations will have to be considered. And lastly, an IC strategy will have to be employee-focussed. These strategic imperatives are developed in more detail in the following paragraphs.

IPR's in a knowledge economy: transacational tools

Limitations of the traditional view of the policy goals of IPR's

Theory would have it that the granting of intellectual property rights in new knowledge enhances innovation: intellectual property rights are granted in response to market failure in the market for new knowledge. Sub-optimal levels of production of intangibles are said to occur because intangibles can be used without being depleted; have public good characteristics, ie are subject to positive externalities which cannot be captured by the creator; and the marginal cost of use or reproduction of intangibles is minimal compared to the cost of initial creation. Simply put, market failure results, because returns on investment in the production of knowledge and information cannot be captured in the absence of property rights. The first producer of knowledge will be trumped by the free rider who can use the knowledge while avoiding the cost of knowledge production and only suffering the marginal cost of imitation.

Yet it is clear from what little empirical data are available, that many industries do not consider intellectual property (patents in particular) relevant to the decision whether to innovate or not[42]. Whether and to what extent intellectual property law encourages firms to innovate is a very open question. The devil lies in the detail: *the wrong kind or scope of intellectual property laws can even have a detrimental effect on innovation rates*[43].

In today's context, it may be that market and technology related factors have a far greater influence on the rate of imitation[44]. For one thing, the marginal cost of imitation is often underestimated or misunderstood. Intellectual property as codified knowledge is not necessarily readily deployable by a competitor, and the cost of acquiring useful knowledge will thus often be higher than the cost of acquisition of codified intellectual property. The imitator must engage in a more or less costly learning process, and must develop or acquire the tacit knowledge and know how that are not revealed by the codified knowledge or the product itself[45]. In other words, there is an imitation lag that allows innovators to consolidate market position, the so-called first-mover advantage.

Further more, in a knowledge economy, with its pervasive networks and all-embracing standards, the distributed base of a new technology and the relationships built around the technology may pre-empt imitation and market entry by a competitor far more effectively than intellectual property law ever would. As technology becomes more complex, interdependency between innovator and customer becomes an important factor that bars customer transition to a competing (cheaper) imitator. And technological interdependency between competitors will tend to organise imitative conduct more than legal rules will[46].

In any case, innovation rates (ie the rates of substitution of new technology) have risen so dramatically, that one comes to a stage where the *imitation cycle is longer than the life cycle of the product*, and imitation becomes a pointless activity.

That intellectual property has unknown effects on the rate of innovation does not mean that it is not a valuable tool of the knowledge economy. The point is that intellectual property law enables *participation* in the knowledge economy, rather than *exclusion* from it. In a networked, hi-tech, high innovation economy, a firm's intellectual property is as, or more, useful as a *bargaining* than as a *barring* tool. Enforcement of intellectual property rights then takes on the role of sign-posting appropriate rules of market behavior rather than effectively denying imitation and copying.

Bartering knowledge with IPR's

Intellectual property, which tends to require material form and some precision in identification, aids with inventorying of intellectual capital. This process then also allows a firm to use a form of shorthand in advertising its intellectual capital base, without having to fully catalog the information as such: for instance, the number of patents in a firm's portfolio is an indicator of its level of intellectual capital. Demonstrable ownership of copyrights, design registrations, trade marks, circuit layout rights is advantageous in terms of valuing the firm, of attracting finance, of retaliation when faced with infringement litigation, and of commercial negotiations relating to licensing[47].

Intellectual property inventories also have considerable advantages to a firm because they enable participation of the firm in the networked knowledge economy. Knowledge is more and more

complex and it is increasingly impossible for a single firm to 'own' all relevant knowledge that it needs to provide a complex technological product or service[48]. In such conditions, the strength of IPR's will be as a bargaining tool rather than a barring tool (ie barring imitation by threatened litigation).

The resulting networked economy operates partly through *knowledge barter*: in other words, cross-licensing of intellectual property rights. The key is to focus on those advantages and to dismiss the illusions concerning IPR's as barring rights in any but the rarest cases. This is not to deny that litigation against imitators sometimes has strategic advantages. But an investment in building knowledge inventories will be much more readily justifiable that investing in litigation.

The effect of the growth in proprietary knowledge

Various trends have resulted in a growth of proprietary knowledge. First, more knowledge is subject to appropriation because legislators and courts tend to expand rather than contract the categories of protection; secondly, firms (and other agents, such as universities) are increasingly interested in obtaining proprietary rights; and thirdly, as the economy goes global, firms tend to obtain rights in a plurality of jurisdictions to a greater extent than before. The result of these trends is that firms will find themselves at risk of being barred from access to vital information that previously may have been in the public domain.

The only way of maintaining access to vital knowledge and technology is through developing *proprietary networks* of knowledge, ie networks of exchange of proprietary knowledge. Such networks function on the basis of confidentiality and reciprocity, ie cross- licensing arrangements. This is all the more the case where there is considerable pressure on patents law to move towards rewarding investment in research rather than inventiveness in research, certainly in highly scientific areas such as biotechnology[49]. Again, building knowledge inventories will be the key to successful participation in proprietary knowledge networks.

IC strategies: integrating reliance on IPR's with other approaches

The high cost and other shortcomings of IPR's imply that for a firm concerned to limit the effects of competitive imitation, alternative strategies *not reliant on IPR's* may be more efficient and more cost-effective. Alternatively, a firm should consider integrated strategies that *combine* reliance on IPR's with other approaches in a holistic fashion. I address some examples of both below.

Perpetual innovation

Probably the most effective strategy that does not rely on intellectual property rights, is perpetual innovation. In absolute terms, that is nothing new: simply put, it's staying ahead of the competition. But it is new in degree, in the sense that it requires the *primary focus* of the firm to be the management of knowledge for *perpetual* innovation. As I said above, because obtaining and enforcing IPR's is so costly and slow, litigation or disputes often revolve around yesterday's technology. Rapid rates of technological change make that even truer today than it was in the past. Thus if a firm no longer relies on a technology or product for profitability, there will be little gained from enforcing IPR's. But the choice is not there unless a new technology or product can be substituted for the old. It is this process of constant intra-firm technological substitution that will liberate the firm from the need to pursue costly and high-risk strategies of reliance on and enforcement of rights in existing technologies and products. However, the effectiveness of a strategy of constant innovation will depend on a number factors, not the least being the installed base of the technology.

Client inclusion in the innovation process

I pointed out above that building proprietary knowledge networks is crucial in a knowledge economy. However, since successful innovation is often dependent on detailed improvements of an initial product, tying in access to the knowledge resources of clients will also be of vital interest to an innovative firm. Clients are important source of product knowledge, and the firm that maintains a two-way client relationship guarantees access to a vital future resource. Such relationships can be maintained by legal means (contractual provisions in licensing or supply agreements), but can also be maintained at the informal level and at the level of employee interaction. Mobility of employees between innovator and client is most useful in this respect.

IPR's as technological determinants

In terms of product choice and design strategy, designing products to maximise imitation lag is a well known strategy. But it is not unreasonable to suggest that the nature and extent of available IPR's should be taken into consideration in the course of the design process. How well does the design of a product protect the firm's intellectual capital, and are there changes in design that will make reliance

on IPR's as barring tools more effective? There are of course technical and commercial limits to the extent to which IPR's can shape the design of a product, but since the IC of the firm is such a core asset in a knowledge economy, it is reasonable to suggest that such considerations should have a place. Some design elements may be purposely introduced to make detection and proof of imitation or infringement easier (the deliberate spelling error example). In other cases it is a question of preferring design choices that make imitation and reverse engineering harder and detection easier at the same time.

Imitation

An innovator is inevitably also an imitator, and the cost of imitation tends to be lower than the cost of innovation (hence the existence of IPR's). There is of course a risk of legal liability inherent in imitation. But the scope of IPR's tends to be quite narrow, so that the substance of innovative ideas can often be acquired without infringement, making imitation a sound and cost-effective strategy. Imitation in effect amounts to another form of acquisition of innovation. The imitation/innovation decision is one that has to be made with regard to the existence and effectiveness of IPR's. Much advantage may be derived in terms of IPR's and strengthening a firm's bargaining position by a strategy of imitation *and* innovation. The development of improvements on a patented technology owned by a third party may give rise to an improvement patent; or ideas contained in a copyright based product may be re-deployed to greater effect or with greater graphic skill etc.

Staged release

A concomitant of perpetual innovation is staged product release. Many modern technologies are science-based and thus generic. They lend themselves to a multitude of different applications, forms, improvements, adaptations and efficiency gains. Many factors determine the timing of market introduction, but there is usually little to be gained by extending the delay between invention and market entry. IPR's tend to apply to *evolutionary* changes as much as to *revolutionary* breakthroughs. The standard of inventiveness for patents is actually quite low, and the merit of the subject matter is irrelevant: a 20 year patent is available for an improved ironing board just as much as for a revolutionary cancer-treating drug. Improvement patents may extend the effective monopoly over a technology. In copyright law, the standard of originality is very low in Australia[50]. Fairly minor changes to existing copyright works may result in an original work or subject matter that separately attracts copyright. Where the author of the changes is not the original author, the term of copyright may be usefully extended[51]. And designs registration is available for 'new or original' designs, but this usually requires only small changes in the appearance of a product[52]. Thus IPR's can be obtained and managed in a manner that will extend the effective life of legal protection of a basic innovation in technology or design.

Being pro-active

Because of the structural characteristics of the subsistence requirements of IPR's, failure to act early can cost innovators dearly. Options may be irrevocably lost by the failure to observe requirements for subsistence of IPR's, for instance, by revealing information before the filing of a patent application. In other words, the structure of IPR's rewards the pro-active firm which has structures in place for the early identification and processing of emerging IPR's. A relatively small initial investment may secure a valuable future position.

Being pro-active can come at a cost, but savings at the early stage are false savings: initial costs are low, and a firm can opt out (allowing an application or registration to lapse) but cannot opt in (because novelty will have been lost). Costs can also be deferred for a considerable time without loss of privileges once the initial application is made.

Strategic considerations undoubtedly come into play in pro-active decisions concerning the protection of rights, and these must be carefully evaluated. For instance, at what stage in the product development cycle does the firm apply for a relevant patent? Applying for a patent marks a transition from secrecy to publicity (although this may vary between jurisdictions depending on whether the application is published or not), and is therefore a strategically important decision. The choice between reliance on trade secrets law and on a patent, depends on many different factors, not least the nature of the technology involved. But the fact that there may be risks inherent in an early application does not mean a firm should not be proactive; the essential requirement is that, as a matter of course, active consideration is given to IPR protection as early as possible in the product development cycle.

Cumulating rights

Cumulating IPR's is also an effective way of enhancing the value of the intellectual capital of the firm. Modern intellectual property law permits of

more overlapping between different forms of protection. Examples are copyright and registered designs (which can be cumulated in some jurisdictions but not in others – or not wholly); designs registration and trade marks registration (because in most jurisdictions shape and packaging of goods can now be registered as trade marks); copyright and trade marks registration; etc. Some concrete illustrations: reliance on trade dress and on registered trade mark protection; ensuring a remedy against piracy of software by inclusion of a trade mark in software, so that an action can be brought in copyright and trade marks law; and grant of a software patent which gives the option of both relying on copyright protection and patents protection.

A firm with more options will usually enjoy a wider scope of protection. Remedies may differ between regimes, and exceptions under one system may be inapplicable in another. As already referred to above, registering multiple IPR's within a single regime may also be effective, eg a general and improvement patents; product and process patents; registered trade marks in different signs; registered designs in slight modifications of the same design; etc. Some intellectual property regimes specifically allow for the registration of a number of similar or interdependent rights.

Investing in goodwill or in innovation?

The goodwill vs innovation trade-off

There is a basic distinction in intellectual property law between rights in *goodwill* and rights in *innovations*. A firm must optimise the choice between investment in innovation or in goodwill. In making this choice, it must evaluate the structural differences between the protection of goodwill and of innovation (in the broad sense) in intellectual property law. More precisely, it must assess the advantages reliance on trade marks registration and/or passing off may have over exclusive copyright, design and patent rights.

The goodwill of a firm resides in the signs that consumers associate with it. Distinctive signs that are not confusing can be registered as trade marks and thus 'owned'. Although trade mark registration may obviate the need to prove reputation and misrepresentation or deception in a given case, it admittedly has its limitations. Only certain signs can be registered, and they tend to be only a small fraction of the total interface between firm and consumer. Furthermore, the monopoly is only in relation to a certain class of goods or services (although well-known marks may generate a wider scope of monopoly) and is conditional on intended and/or actual use. Registration is also national, not international, which can leave well-known marks vulnerable in foreign markets. Trade mark registration is generally also subject to good faith-use exceptions and other derogation's, and the validity of a trade mark is not guaranteed by registration. If a trade mark is not well managed, it can be the victim of its own success and become generic rather than distinctive of the firm. Careless licensing practices can also result in trade marks becoming confusing or deceptive, or descriptive rather than distinctive of the trade mark owner, with a consequent loss of monopoly.

An alternative to reliance on registered trade mark rights is to have recourse to an action in passing off, misleading and deceptive conduct, unfair competition or the like, in relation to trade dress and other distinctive indicia of a firm's business or products. The evidentiary burden in such actions is greater, reputation and misrepresentation needing to be established in every case. Courts tend to be reluctant to enforce a monopoly in the appearance or design of a product through means of an action in passing off or sec 52 TPA in imitation cases (registered designs being the more appropriate avenue for protection).

Advantages of goodwill

Despite the abovementioned limitations, the protection of goodwill has several great advantages over monopolisation of ideas. First, it is not necessarily *product* specific, but can be – and frequently is - *firm* specific. The effective 'protection' of a product through designs, copyright, patents etc. might have to rely on a multitude of rights in constituent parts, creating potential transaction and management costs. Firm-specific goodwill does not suffer from this disparity: in other words, it is an over-arching right, certainly if effectively managed. This reduces transaction costs and increases the value of *all* products of the firm, ie firm-specific goodwill enhances the value of all other intellectual capital of the firm.

A further advantage lies in the continuity of goodwill: protection does not run out. As long as a trade mark is used and does not become descriptive, deceptive or confusing, registration can be maintained. There is no cut-off date as there is in relation to other IPR's. The same effectively applies to unregistered trade marks and other elements of trade dress. The value of a trade mark therefore potentially increases with the passage of time, with *increasing* returns on investment in goodwill. A firm

does not have to reinvest in a *new image* at given intervals, although it can choose to do so. Contrast this with the diminishing returns from investment in patents, designs, copyrights etc., which require a firm to invest in substitute innovations to maintain its monopoly position. Well-known merchandising characters are a good example of this: while the copyright in Mickey Mouse runs out 50 years after the death of its author, the Mickey Mouse trade mark can be maintained forever. Thus strategies that *convert* or *leverage* substance into goodwill have marked advantages.

Goodwill protection is also less susceptible to subversion by new technologies than substantive rights. Copyright, for instance, has arguable failed to protect the interests of authors, composers and producers in relation to sound recordings on the Internet. At the same time, returns to musicians and producers from merchandising and other goodwill related activities have remained constant or grown, and are less affected by technological change. Arguably, an international trend in favour of goodwill protection is, not surprisingly, developing; moves to dramatically increase protection for geographical indications are illustrative of this.

Investing in goodwill or in innovation?

Therefore investment choices in relation to the intellectual capital of the firm require careful consideration of the advantages of the protection of goodwill. Relative costs and potential for future returns must be compared. It may be that the exploitation of a successful patent, for instance, under which a new entrant can establish itself in a market, or create a barrier to entry by others, should be seen as the springboard for the longer term development of the goodwill of the firm. In other words, successful innovation should be seen as an opportunity to enhance the value of goodwill, which, when the monopoly in a patent runs out, can be maintained. Other products can then be developed under the 'umbrella' of continuous rights over goodwill, which will in turn enhance the value of future innovations, and so on. Thus innovation is *leveraged* for a future return in terms of the firm's goodwill or reputation.

The *balance* between investment in goodwill and other forms of IPR must depend on the circumstances of each firm and on its technological base. Investment in goodwill and innovation are not mutually exclusive. For instance, image building as a market-leader in innovation is a well-established strategy. And since reputation is as much about the quality of employees as about image-building, investment in people is an effective investment in goodwill. Strategies that attract and retain good employees will enhance business reputation, and enhance the value of those indicia of goodwill and reputation which a firm will be able to trade off in the future.

Employee related strategies

Tacit knowledge of employees

Tacit knowledge is carried in the heads of employees, and in that form the law ensures that it remains quite mobile and rather outside the scope of legal control of the firm (see above). On the other hand, the law in most nations recognises that employers own the intellectual property rights in employees' (patented) inventions, although there are some limitations to this rule[53]. In this light, it seems to be to the advantage of the firm to pursue two strategies[54]: first, externalising tacit knowledge; and secondly, attracting and retaining inventive employees.

Externalization of knowledge - subject as it is to inherent limitations, because of the dynamic quality of knowledge - codifies tacit knowledge. It can then be rendered subject to IPR's. This has all the general advantages referred to above, and also strengthens the hand of the firm if a dispute concerning trade secrets or confidential information with an employee ensues in the future. Externalising tacit knowledge also allows a firm to build a more comprehensive knowledge inventory. The firm only obtains a return on investment in training if the employee is retained, or – to a degree at least – if the tacit knowledge of the employee is rendered explicit.

Externalisation of knowledge can be encouraged in various ways: by offering employee – incentives (eg in the form of co-ownership of patents); by way of building in externalising procedures (eg maintaining logbooks; computerisation of procedures); by making employees aware of the value and importance of IPR's, and of obligations in relation to confidentiality and notification. It may even enhance a firm's position to encourage and support employees in establishing spin-offs and start-ups (subject to the firm having a stake). Strategies that encourage employees to externalise and be open about their inventions need not go to the length of promising full or partical employee ownership, but could take the form of a right to a royalty from commercial exploitation, or salary responses depending on the number of registered IPR's with

the employee's as named inventor[55].

Retaining employees: 'incentivisation'

But maybe more important than externalisation strategies is effective management aimed at retaining inventive employees. The strategy examples given in the previous paragraph are at least first steps in that process. They help the firm to identify the most valuable employees, and thus to offer timely incentives and rewards related to the production of IPR's. But intellectual capital is more than IPR's, and broader incentives of a more traditional kind might be more appropriate or effective. Nonetheless, there are advantages in tying employee reward more explicitly to the contribution to the intellectual capital of the firm.

Conclusion: Integration Between IP And Non-IP Strategies

The main point made in this paper is that intellectual capital is a broader concept than IPR's. To enhance the value of intellectual capital, the firm must use IPR's in combination with other strategies, while being fully cognizant of the strengths and weaknesses of the various IP regimes. The intellectual capital of the firm is its main asset in a knowledge economy, increasingly characterised by technological interdependency. Given the nature of IPR's, it is more effective to think of IPR's in terms of bargaining tools in such a market. Furthermore, there are other strategic decisions relating to intellectual property law that a firm must take with full recognition of the real limitations and real promise inherent in the various areas of intellectual property law. Thus a firm will have to focus on strategies to maximise the value of tacit knowledge, and also consider the value of goodwill over innovation when investing to enhance the value of intellectual capital.

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1. There are now many works that analyse intellectual capital from a management perspective: see for instance, Roos J, Roos G, Edvinsson L & Dragonetti NC, *Intellectual capital: Navigating in the New Business Landscape* NYUP (1998); Edvinsson L & Malone MS, *Intellectual Capital*, HarperBusiness (1999); Sullivan PH, *Profiting from Intellectual Capital: Extracting value from innovation*, John Wiley & Sons (1998). A useful recent work, from the perspective of intellectual property law and intellectual capital, is Imparato N (ed), *Capital for our time: the economic, legal and management challenges of intellectual capital*, Hoover Institution Press (1999). The notion of intellectual capital is not new, but the degree of attention it has received is.

2. Much of the recent thinking about intellectual capital revolves around the fact that it is not visible on the balance sheet, or alternatively, around attempts to render it visible on the balance sheet. However, even though some aspects of intellectual capital are by their nature impossible to measure, in fact they contribute greatly to the value of the firm as demonstrated by the valuation of its stock. For instance, the discrepancy between stock valuation of GM and Microsoft is much smaller than the discrepancy between the values of its traditional net assets (land, buildings, equipment etc, but not IC; see Roos, above 1, at p1).

3. In fact one of the difficulties with the concept of intellectual capital is that on present understanding, it is impossible to define adequately or to develop an accurate taxonomy of its elements. This results in the use of general terms that add little to our understanding; for instance, Klein refers to 'knowledge, experience, expertise and *associated soft assets*, rather than hard physical and financial capital', see Klein A, *The strategic management of intellectual capital*, Butterworth Heinemann (1999), at 1.

4. More or less complex definitions of these terms have been offered. For instance, Boisot makes a careful distinction between data, information and knowledge. Data are 'discernible differences between alternative states of a system'; information is 'data that modifies the expectations or the conditional readiness of an observer'; and knowledge is 'the set of expectations that an observer holds with respect to an event': see Boisot, MH, *Knowledge assets, Securing competitive advantage in the Information Economy*, OUP (1998). Whether such precise definitions are helpful beyond the immediate aims of their author is doubtful.

5. References to both the 'information economy' and the 'knowledge economy' are rife, often without clear distinction being made between the two, whether purposefully or by inadvertence. The Merriam-Webster Collegiate Dictionary (online) definition of knowledge is 'the fact or condition of knowing something with familiarity gained through experience or association (2): acquaintance with or understanding of a science, art, or technique b (1) : the fact or condition of being aware of something (2) : the range of one's information or understanding "answered to the best of my knowledge" c : the circumstance or condition of apprehending truth or fact through reasoning : COGNITION d : the fact or condition of having information or of being learned "a man of unusual knowledge"'.

6. Hence the emphasis on *learning* in a knowledge economy, and the emphasis on the firm as a learning organisation.

7. See Roos, above 1.

8. On the whole the law is unwilling to restrict the mobility of employees, or to restrain them from using knowledge acquired in the course of employment for themselves or in the service of a different employer. The law relating to employee mobility and control over IP is one of the most crucial areas of law in relation to innovation and technological growth; as to the question of employee mobility and the law in a knowledge economy, see Merges RP, 'The law and economics of employee inventions' (1999) Harvard J of Law & Tech, 13, 1; Bankman J & Gilson RJ, 'Why start-ups?' (1999) Stanford LR, 51, 189.

9. See Conceicao P et al (eds), *Science, technology and innovation policy: opportunities and challenges for the knowledge economy*, Quorum Books (2000); Neef D. "Rethinking Economics in the Knowledge-based Economy.", in *The Economic Impact of Knowledge*, Butterworth Heinemnann, Boston (1998). Neef D, *The knowledge economy*, Butterworth Heinemann (1998); and Neef D, *A little knowledge is a dangerous thing: understanding our global knowledge economy*, Heinemann (1998); or for a combination of both 'knowledge economy', and 'information economy', see Eliasson G, *The knowledge based information economy*, The Industrial Institute for Economic and Social Research, Stockholm (1989). The term 'information economy' is just as common as 'knowledge economy', but from the perspective of intellectual property law, the former is a less interesting concept, since arguably IPR's are more concerned with knowledge than information.

10. Added value is a loose descriptor: I mean that the market will sustain higher prices for intellectual capital-value added goods and services.

11. The same in fact applies to goodwill as well as to technical knowledge. The weight of a generic coke drink can is the same as that of a Coca Cola can, but the value of the latter is greater because of the intellectual capital in the form of goodwill that the Coca Cola trade mark represents.
12. In economic terms, it is not an exogenous variable; knowledge is integral to market equations, not a factor of supply that is unaffected by market conditions.
13. It is possible to associate the growth of the knowledge economy with the post-cold war period, with its shift from public to private determinants of expenditure on new knowledge production brought about by the reduction in military spending. This constituted a shift away from government direction of the expenditure of innovation resources.
14. A 'business method' patent is in fact a misnomer: see Welcome Real-Time SA v Catuity Inc [2001] FCA 445 (17 May 2001). See for instance, Merges R, 'As many as six impossible patents before breakfast' (1999) Berkeley Technology Law Journal 14, 577; but whether or not such patents are economically justified, and in spite of doubt about the validity of business methods patents, industry has certainly embraced them in the United States, as have legal practitioners: see eg Kang PH, Snyder K, 'A practitioner's approach to strategic enforcement and analysis of business method patents in the post-State Street era', (2000) IDEA – The journal of Law and Technology 40, 267.
15. As the learning process of employees is one of, if not the principal way of, acquiring knowledge assets. Previously such acquisition has been largely non-transactional, but in the future that will be less and less the case: training and continuing education of employees will become a greater cost for firms as it becomes less of a public sector function.
16. Ie more based on learning by structured study than learning by doing. This also means that the pattern of technological change is modified. Theorists now tend to identify a distinction between paradigmatic shifts in technology and steady and predictable changes in technology. According to Duysters, 'Over time a product or technology is likely to arise which stands out above all other products or technologies. These so-called 'basic designs' serve as sorts of 'technological guideposts' for further developments in technology. Once a basic design is established, technological progress tends to follow consistent paths or trajectories. The cumulative character of technological progress facilitates a rapid expansion of the boundaries of the technology until the natural limits of the technology are approached and technological progress slows down. At that time decreasing returns from investment in research and development induce firms to redirect focus towards other technological paths.', see Duysters G, *The Dynamics of Technical Innovation*, Edward Elgar (1996), at 213. The development of 'basic designs', or what one might call generically new technologies, will come about more frequently the more scientific investigation occurs. See also Flueckiger GF, *Control, information and technological change*, Kluwer (1995): scaling a technology leads to a path of predictable technological change, citing Sahal who defines technological evolution as 'a process of learning by scaling', at p 17.
17. With more investment in science generic breakthroughs become more common.
18. Literature on the management of knowledge is common; see eg Momberg D, Ashton A, *Strategy in the use of intellectual property; a guide to managing business' most valuable asset*, (1986) Gerundive Press, Hong Kong. The Internet as an example: those firms that obtain and manage client information most effectively will be the winners.
19. See Boisot M, *Knowledge assets* OUP (1998): knowledge assets substitute for physical assets as the process of learning progresses.
20. The development of social networks in the 'informational society' and the role of information technology is now a common topic in sociology (see eg Castells M, *The rise of the Network Society*, Blackwell (1996)). I use the terms 'knowledge networks' more narrowly to refer to the manner in which firms in the knowledge economy depend on networks for access to and distribution of knowledge assets.
21. See Merges R, 'Intellectual Property Rights and the New Institutional Economics' (2000) 53 Vand L Rev 1857.
22. See Merges R, 'Intellectual Property rights and the New Institutional Economics (NIE)', above 21. NIE is, according to Merges, 'all about coordination between multiple economic units', inter alia in terms of vertical integration, but principally in relation to inter-firm coordination
23. This is sometimes advanced in support of broader scope patents. Variations in patent scope impact on the nature of the relationship between owners of disparate technological components, or between 'pioneers' and 'improvers'. The grantee of a broad patent will profit either by licensing, or through joint ventures, from the creation of further applications of the patented technology. Firms other than the initial inventor may in fact have superior expertise in identifying and implementing further applications. The grant of patent rights thus serves to co-ordinate the R&D efforts of downstream inventors in an efficiency-enhancing manner. However, it may be that coordination of research activity is in fact more efficient between owners of various related patents than between one owner of a broad patent and a number of innovators willing to develop the patented technology further.
24. The customer's investment in training in a new product results in so-called 'customer groove-in', ie reluctance to switch between systems because of the loss of the investment in training in the old system and the cost of re-investing in training in a new system: see Roos, above 1, p 12. Note however that modern technology is flexible, ie subject to a continuous process of error correction.
25. Or network externalities. See Lemley MA, McGowan D, 'Legal implications of Network Economic Effects' (1998) California Law Review 86, 481. In the area of intellectual property law, the phenomenon of network economic effects tends to indicate the desirability of exceptions to intellectual property rights in the interest of compatability, eg in relation to reverse engineering of computer programs and reproduction of interface components.
26. Eg the value to A and B of software that allows their computers to communicate over the Internet is limited; if every computer owner has the software installed the value is far greater.
27. An excellent example of this is copyright law protection in relation to computer programs in the absence of reverse engineering enablement provisions.
28. In an industry where market and technological uncertainty are high, first mover firms have a great advantage in preempting new market opportunities: see Duysters G, *The dynamics of technological innovation*, Edward Elgar (1996), at 214. New entrants are likely to enjoy benefits over established firms because the investment in innovation does not have the same opportunity cost: see Duysters, above 16, at 216. In other words, investment in innovation as a way of reducing costs in an existing organisation is in itself costly and subject to risk.
29. Only information that can be classified as trade secrets (or confidential information sensu stricto) is subject to legal restraints. Most often employees will fall foul of such restraints only if they have taken information from an employer in some codified form, such as papers or computer files.
30. In other words, firms can develop ties to tacit knowledge by developing structures that allow access without appropriation, to the most valuable of tacit knowledge assets. Ties to tacit knowledge not only assist the firm to be profitable, they also affect the market value of the firm: see eg Darby, Liu and Zucker, 'Stakes and stars: the effect of intellectual human capital on the level and variability of high-tech firms' market value', NBER Working Paper Series No 7201 (1999) (concerning the effect of ties with star scientists on share value).
31. Trade marks registration requires use of the mark to remain valid, and a mark that is not, or no longer is distinctive, or that is confusing or deceptive to the consumer, may also be removed from the register.

32. All members of WTO must (eventually) abide by the TRIPS agreement.
33. In other words, although standards may be converging, registration must be sought in each country, and the laws of each jurisdiction (with all their distinct approaches, despite common treaty obligations) will differ, as will the level of effectiveness of the enforcement mechanisms available. An exception may be the new domain name rights on the internet.
34. For instance, specific exceptions may exist in one jurisdiction and not another, or be different in scope; some subject-matter may be expressly excepted from protection in some jurisdictions and not in others.
35. Which means that protection may or may not be available: for instance, whereas business method patents can now probably be patented in the US (see *State Street Bank & Trust Co v Signature Financial Group Inc* 149 F. 3d 1368 (Fed Cir 1998)), this is not the case in most other jurisdictions; see also the American Inventors Protection Act, November 29, 1999 (Intellectual Property and Communication Omnibus Reform Act of 1999, Title IV – Inventor Protection), which effectively recognises the patentability of business methods.
36. A survey has estimated the median cost of litigating a patent in the US at US$ 1.5 million: AIPLA, Report of Economic Survey: 1999, Table 22. See also Kingston W, 'Reducing the cost of resolving intellectual property disputes' (1995) European Journal of Law and Economics 2, 85 – 92.
37. The choice between secrecy and publicity is usually a choice between patenting and relying on trade secrets law. The choice may not be absolute, but one of timing. The timing of the filing of a patent application is an important policy issue, as it is often thought that the wider the scope of patents that the law permits, the earlier patent applications will be filed. The earlier an application is filed, the sooner competitors will desist from identical research paths. This will limit the cost of duplication of investment in research in a race to invent. On the other hand, this may increase the monopoly cost on society because of the scope of the patent granted, and will result in the problem of so-called 'blocking patents', and unjustifiable limitations on improver inventions. See Grady MF, Alexander JI, 'Patent law and rent dissipation' (1992) 78 Virginia Law Review 193; Merges R, 'Rent control in the patent district: observations on the Grady-Alexander thesis' 78 (1992) Virginia Law Review 359; Kitch, EW 'The nature and function of the patent system' (1978) J of L & Eco 20, 165; Merges, R, Nelson R, 'On the complex economics of patents scope' (1990) Columbia Law Review 90, 839. As to blocking patents, see Scotchmer S, 'Standing on the Shoulders of Giants: cumulative innovation and patent law (1991) 5 J Econ Persp 29; Green J, Scotchmer S, 'On the division of profits in sequential innovation' 26 Rand J Econ 20 (1995); Lemley MA, 'The economics of improvement in intellectual property law' (1997) Texas Law Review 75, 989.
38. The fact alone that information incorporated in a machine is encrypted does not mean that the purchaser is subject to an obligation of confidence not to access that information by reverse engineering (eg disencryption): see eg *Mars UK Ltd v Teknowledge Ltd* (1999) Ch D (Jacob J) 11/6/99.
39. On this issue see Ellis TS, 'Distortion of patent economics by litigation costs', in CASRIP, Streamlining International Intellectual Property (Hill et al eds) (1999), arguing that because of high costs of litigation weak patents amount to as high a barrier to entry as strong patents, thus distorting patent economics.
40. A recent study shows that approximately 54% of all litigated patents in the US between 1989 and 1996 were held valid, with little variation between different areas of invention, although some areas of invention were rarely litigated to a final conclusion: see Allison JR, Lemley AM, 'Empirical evidence on the validity of litigated patents' (1998) AIPLA Quarterly Journal 26, 185. A recent study of published Australian court decisions concerning validity of patents in the period 1990 – 2000 established a failure rate of 66% (and an overall failure rate in terms of obtaining a remedy against an alleged infringer of 80%): see Drummond D, 'Are the courts down under properly handling patent disputes?' (2000) IP Forum 42, 10.
41. There is some indication from empirical data that this is what firms do; the average time in the US between application date and the resolution of a lawsuit is 12.3 years.. That tends to suggest that firms are protecting an established market position dependent on outdated technology, against the introduction of an innovation which will affect their market: see on this topic, Lemley M, 'Reconceiving patents in the age of venture capital' (2000) The Journal of Small and Emerging Business Law 137 at 141. See also Barton JH, 'Reforming the Patent System', SCIENCE, Vol 287, 17 March 2000, 1933.
42. In fact recent scholarship concerning the effect of patents on innovation tends towards stressing that patents may be useful, not so much as incentives to innovate, but as property rights that form the basis for transactions in the networked economy, ie as a mechanism of exchange rather than prohibition: see eg Lemley MA, 'Reconceiving patents in the age of venture capital', (2000) The Journal of Small and Emerging Business Law 4, 137; Allison J, Lemley MA, 'Empirical evidence on the validity of litigated patents' (1998) AIPLA Q J 26, 185. In the US, the economist Fritz Machlup concluded that it would be irresponsible to create a patent system if the US did not have one, but also irresponsible to abolish the one they had (see Staff of Senate Subcommittee on Patents, Trademarks and Copyrights, 85th Congress, 'An economic review of the patent system: study No 15, at 80 (Comm Print 1958)). In Australia Mandeville, Lamberton & Bishop came to exactly the same conclusion: see Mandeville, Lamberton & Bishop, The economic effects of the Australian Patent System (1982). See also Lamberton D, *Science, technology and the Australian economy*, Tudor Press (1970).
43. See for instance, Barton J, 'Reforming the Patent System', above 41; Barton J, 'Patents and antitrust: a rethinking in light of patent breadth and sequential innovation' (1997) Antitrust Law Journal 65, 449; Merges P, 'As many as six impossible patents before breakfast: propert rights for business concepts and patent system reform' (1999) Berkeley Technology Law Journal 14, 577. Much of the focus is on the potential chilling effects of doubtful patents, and on the potential for abuse of patent power, in particular by multiple patent owners. Patents can be construed as barriers to market entry. In terms of copyright, the anti-competitive potential of computer program protection has been a long-standing bone of contention.
44. Some empirical research has shown that the impact of patents on the cost of imitation is minimal: see Mansfield, Schwartz, Wagner, 'Imitation costs and patents: an empirical study' (1981) The Economics Journal 91, 907-918.
45. In fact there is considerable general ex-ante cost involved, in advanced industries, in simply keeping up with developments in the field, as well as the cost involved in acquiring market capabilities in a new technology.
46. Competitor A, a licensee in relation to technology Z from competitor B is less likely to avoid payment of a fair royalty to competitor B for technology Y and vice versa.
47. As to other advantages in relation to patents, see also Lemley MA 'Reconceiving..', above 42 at 142 - 144
48. Concerning the importance of the multiplicity of IPR's embodied in a single product, Merges R, 'Intellectual Property Rights and the New Institutional Economics', above 21.
49. In the US, for instance, there is arguably an increasing trend to have regard to the effectiveness of a firm at marketing innovations rather than only the inherent merit of the invention, by accepting the relevance of secondary factors such as the commercial and licensing success of an invention in assessing inventiveness: this thesis is put forward in Merges P, 'Commercial success and patent standards: economic perspectives on innovation' (1998) 76 California Law Review 805. That evidence of the application of routine but time-consuming methods of investigation should be treated as relevant in determining inventiveness in patents law was argued in some important UK decisions: see eg *In re Genentech's Patent* [1989] RPC 147; *Chiron v Organon Teknika* [1993] 12 EIPR D-285; *Amagen v Chugai Pharmaceutical*, 927 F.2d 1200,

1991; and *Biogen v Medeva*, [1995] RPC 68.
50. See eg *Telstra Corporation Limited v Desktop Marketing Systems Pty Ltd* [2001] FCA 612 (25 May 2001): white pages attract copyright protection.
51. See for instance the discussion in *Interlego AG v Croner Trading Pty Ltd* (1993) AIPC 90-956; (1992) 111 ALR 597; (1992) 25 IPR 65; (1992) 39 FCR 348.
52. See sec 17 Designs Act 1906 (Cth).
53. For instance, employees have more extensive rights to their inventions in Germany (see Employed Inventors' Law of 1976) and also in the UK, although in the latter the employee's rights are more restricted (share of windfall profits). See, with respect to the argument as to the most appropriate statutory rules concerning employee inventions, Merges R, 'The law and economics of employee inventions' (1999) Harvard Journal of Law and Technology 13, 1.
54. As to employee-related strategies in the knowledge based firm, see Harvard Business Review, *On knowledge management* (1998); Horibe F, *Managing knowledge workers: new skills and attitudes to unlock the intellectual capital in your organization*, Wiley (1999).
55. University employees are in a special position. Divergent rules and customs have applied to academics for many years, giving them greater rights to certain forms of IP. In terms of patented inventions, there may be good arguments, related to academic freedom and independence, to grant them ownership rights. On the other hand, this can in fact amount to an expensive burden to bear.