# 1

# Introduction

**[This chapter]** This chapter concerns the relationship between intellectual property (IP) law and innovation in technology and product design in general. Further chapters return to this topic but within the specific confines of particular legal regimes, such as patents, designs or copyright. A major premise underlying this book is that innovation and imitation are predictable competitive behaviours in a market economy. The choice between the two strategies, in the absence of rule constraints, seems to favour imitation: innovation is uncertain, requires diversion of scarce resources from other activities, and risks immediate subversion by competitive imitation. Imitators on the other hand tread a known path, avoid all the risk and expense of innovation, and can enjoy the full benefit of their natural advantages. Nonetheless, to innovate is a natural ambition, and non-legal strategies allow innovators to capture greater returns from innovation than imitators. Naturally, even though we speak of imitation and innovation as alternatives, they are often closely intertwined processes: firms innovate but also imitate, or imitate but also innovate, and the competitive process may not be accurately identified as entirely one or the other.

**[Law, innovation and imitation]** Certain parts of intellectual property law act to recast the parameters within which imitation/innovation decisions are made. These rules constrain imitation as a competitive conduct. The central argument justifying this normative interference is that greater social welfare results where the 'natural' balance between imitation and innovation is disturbed to favour the latter. The harm flowing from lessening competition-by-imitation is said to be outweighed by the advantage flowing from more innovation. It is in this context that the relationship between intellectual property and competition law must be seen: the rules of intellectual property construct a framework of permitted restraints on competition; naturally, competition law cannot therefore operate

with its normal force to destroy these restraints, whether genuinely monopolistic or not. Its normal operation may have to be modified where uses of intellectual property are concerned.

**[Alternative approaches to intellectual property]** This innovation/imitation framework is far from the only prism through which intellectual property law can be viewed. Property theory, the economics of knowledge and information, communications theory, or philosophical (for instance Lockean) approaches are all well established in the literature. But a central focus on innovation/imitation as competitive conduct in industry is peculiarly apt for this book, concerned as it is with intellectual property laws in the realm of industrial production, rather than of artistic expression or communication *per se* (not that these are separated by an unbridgeable chasm). While it provides a macro-framework for analysis of law and policy in this area, it also comfortably accommodates the micro-level of individual, competitive decision-making which is the bread and butter of industry in a knowledge economy.

# 1 Intellectual property law and innovation

## Innovation, competition and intellectual property rights

**[Curiosity and the search for knowledge about the human condition]** Knowledge accumulation, flowing from curiosity and the inherent need to understand the human condition, occurs naturally; only its direction and extent vary with time and place. Knowledge does not necessarily have a scientific basis, it may be religious or mythological; it may be widespread within a community, or jealously guarded by an elite; it may be received or discovered, sacrosanct or open to question. Cultural and religious norms and attitudes will determine the rate and direction of *new* knowledge accumulation. Societal acceptance of scientific method as a valid source of knowledge results in the accumulation of a body of knowledge which is open to free and general testing and debate, is vindicated by predominant acceptance, and is constantly growing and evolving.

**[Intellectual property and our belief in progress]** One common factor in industrialised nations with a heritage of such free scientific inquiry *and* a relatively long history of intellectual property law is the concept of progress. Belief in progress rejects a world view which prioritises stability and stresses the preordained nature of human living conditions; rather, it is premised on humans' ability to modify them. Knowledge is not simply accumulated for its own sake, but with a view to applying it to practical ends: not only for the sake of *explanation* but also for the sake of *application*. In this environment innovation not only results from doing and improving, but from conceptual advances: inventions, innovations, new products are conceived *from* or *in* theory rather than arrived at by trial and error in-the-doing. Rule structures such as those of intellectual property law that reduce risk for actors engaged in applying

scientific knowledge to practical ends are perfectly attuned to a *progressivist* world view.

**[The innovation dynamic]** Belief in progress also results in a closely integrated mutual dynamic, as innovation (the application of knowledge to new products and processes) feeds the theoretical knowledge base and vice versa. Practical applications also spawn the development of tools that permit more accurate observation and collection of scientific data thus further accelerating accumulation of knowledge. Applied technologies also require further compatible technologies to function efficiently. The injection of scientific knowledge and processes into practical innovation thus undermines predictability, accelerates substitution and obsolescence, and therefore both accentuates risk and drives up innovation costs.

**[How to manage innovation risk]** Natural risk-aversion militates against investing in innovation. But various mechanisms help to manage risk and mitigate its effects. One is to regulate innovation by some mechanism of state planning, thus coordinating all research and development and reducing the risk of wastage by subversion and by duplication. Whatever innovations are produced can then be shared freely by all economic actors. But the planning and *a priori* determination of resource allocation from above for innovation also engenders costs; in particular, wastage caused by the difficulty of predicting consumer choice and demand in relation to products and technologies that are by definition unknown. It is also inherently difficult to 'plan' innovation, since serendipity, cross-fertilisation, imagination, etc are activities that can only be projected or planned with limited efficiency.

**[Open markets and consumer choices]** An alternative is to subject innovation decisions and risk management to market mechanisms: to encourage the development of alternative products and technologies by multiple independent and uncoordinated actors, and to subject those alternatives to *ex post* assessment by consumer choices, rather than an *a priori* determination. Markets thus become a mechanism determining the rate and direction of innovation; not necessarily the *only* such mechanism, but at the very least an alternative to centralised planning of innovation. Intellectual property – the private ownership and control of knowledge – is then the institutional mechanism which enables this process of market determination of innovation investment.

**[The disadvantages of markets for innovations]** Creating this institutional mechanism – determining ownership, scope and interaction of various exclusive or monopolistic (property) rights – comes at a cost to the economy and the community. It is neither cheap nor easy to demarcate knowledge, to erect and police *barriers* between knowledge 'items'. Furthermore, competition results in duplication – ie resources are expended on innovation in competitive conditions which militate against the sharing of information. Where research and development is conducted in secret, firms may continue to invest in innovation that a competitor's unpredicted introduction of a substitute product renders redundant. Others, of whose progress an actor is ignorant, may win the race to obtain

exclusive rights. The law may again be able to mitigate this duplication effect of competitive innovation, but only to a limited extent. Legal rights will never be able to perfectly match the level of monopolisation of knowledge an individual actor may desire.

**[Innovation as an unavoidable risk]** In conditions of (partial) secrecy, ie where a firm has imperfect knowledge of competitors' innovative activity, and of partial legal protection, the innovation dynamic in markets takes on a different quality. The question is rather how to manage innovation, rather than whether to engage in it at all. Managing the risk of competitors innovating will inevitably require *some* innovation strategy on the part of every firm, even if only to maximise the opportunities to imitate (since it is difficult to imitate in the absence of an internal knowledge base). Technological and product innovation then merely takes its place amongst other forms of strategic behaviour that are the bread and butter of competitive conduct: innovation and change on organisational, marketing, advertising, legal, financial or other levels. In this sense innovation is a risk-management strategy attuned to the competitive environment as a whole.

**[Risk reduction]** Reliance on intellectual property rights (IPRs) helps to reduce risk in a competitive market, by allowing firms to capture higher returns from investment in innovation, and denying its advantages to others. Higher returns can also be captured by market behaviour and managerial strategies, of course, and certain innovation activity would remain attractive in the absence of intellectual property law; private investment in innovation would be modified rather than annihilated by abolishing IPRs. Secrecy, market power, lead time, network effects and complexity are all factors that will reduce or delay imitation. Risk can also be reduced by building non-product-specific *goodwill*. Consumer choices can be influenced or manipulated to favour *whatever* product or technology a firm chooses to introduce. The law promotes this risk-reduction strategy by protecting reputation, which encourages consistency and predictability in product innovation: if consumers come to trust a certain firm's *brand* then they are more likely to favour that firm's every new product. To some extent a firm can absorb the risk of constant product innovations by depending on the continuity of its underlying reputation; at the same time, it can leverage consumer perception of recurrent innovations into a continuous reputation for technological leadership.

**[R&D and interdependence]** One result of the transfer of knowledge from the public to the private domain in a property-based innovation system is increased fragmentation. Competitors are not able to possess all required knowledge resources, or access them from a common pool. Knowledge is fenced in, requiring an exchange mechanism to access it, either based on barter or valuable consideration. The need for access to fragmented and dispersed knowledge results in interdependence which in turn encourages cooperation between firms. This mitigates the duplication-of-research problem, and also the fact that private investment tends to focus on downstream innovation, avoiding upstream, theoretical, blue-sky research, where risk and delay to market are too great. This can be addressed by public funding for such research, but *some* level of

coordination and cooperation between firms in upstream research is also appropriate. Increasing product complexity also necessitates a level of cooperation between disparate rights holders at the downstream, commercialisation level. Legal structures peculiar to IP support such cooperation: for example, flexible ownership rules (for instance, provision for joint ownership of intellectual property, and for ownership limited in time and space), assignments and above all licensing. But in this context the law must address the balance between collaboration and monopolisation: while it may be in the public interest that private actors, or public and private actors collaborate at some stage of research, this risks destroying the very market mechanisms that private knowledge ownership intends to support. Collaboration in upstream research cannot be allowed to contaminate competition in downstream product markets, and must not erect unacceptable barriers to entry for actors outside the collaborative cartel; in other words, a finely calibrated system of rules and rights is required.

**[Innovation and scarcity of resources]** Innovation is not just a matter of strategic choice for individual actors. In conditions of growing scarcity of resources in consumption-oriented societies, efficiency gains from innovation may be a *necessity*. From this perspective, efficiency-enhancing innovation equals increased output from otherwise steady or decreasing inputs of capital, natural resources, energy and labour. Therefore in circumstances of growing scarcity of some inputs, measures that encourage private R&D expenditure, or conversely reduce the risks of innovation in the private sector may be called for. However, here a private property rights-based innovation mechanism faces a dilemma because competitive innovation itself – as opposed to its products – is, for various reasons, wasteful. One significant reason is duplication in the race for property rights; another is the inherent unpredictability of the innovation exercise, resulting in wasted investment in dead-end trajectories; and yet another is secrecy, which prevents firms from adequately estimating risk flowing from substitute products or technologies at the time of investment. Therefore although a proprietary system may result in a better approximation between consumer needs and innovation investment, a system that over-incentivises investment in innovation may be counterproductive in terms of overall economic efficiency. Again a finely calibrated system of rules, rights and incentives is required.

**[Competition, innovation and the calibration of rights]** Intellectual property law subjects imitation and knowledge transfer to legal restraints, thus modifying the rate and direction of innovation. It amends the balance between factors that encourage and factors that discourage investment in innovation. There can be little doubt that IPRs enable and accelerate a competitive dynamic, Schumpeter's 'gale of creative destruction': that is, competition with innovation and substitution at its core. On the downside, IPRs potentially *reduce static efficiency*, in that products are made available at higher than marginal cost because they are protected from competition-by-imitation. But on the upside they potentially *increase dynamic efficiency*: more substitute products are introduced, enhancing consumer choice. IPRs do form barriers to market entry, certainly if the

market is conceived of as that for the product protected by IPRs (eg a certain copyrighted song) rather than a more broadly defined product category (eg all songs).

But whether this barrier has a benign economic effect crucially depends on the *innovation threshold*, ie the novelty of the object of IP protection. If barriers to entry are erected against suppliers of *known* products, prices will rise without the benefit of greater choice. Conversely, if a proper novelty requirement is instituted and policed then barriers to entry are apt to encourage the creation and introduction of new products. Crucial also is the *scope of rights*: earlier entrants' IPRs that are too broad will prevent new players from entering markets. But new entrants' IPRs can subvert existing actors' dominance only if they themselves are sufficiently broad, so a fine balance is required.

The two central characteristics of statutory IPRs, the *innovation threshold* and the *scope of protection*, lie at the heart of the continuous development of intellectual property law. Existing rules are constantly reinterpreted by decision-makers and frequently revisited by policy-makers. Certainty appears to be an elusive goal, as empirical evidence about the IPR/innovation relationship tends to be inconclusive and the technological future unpredictable.

## IPRs and knowledge diffusion

**[IPRs and diffusion of knowledge]** Other than interfering with the 'natural' balance between innovation and imitation, IPRs also modify knowledge flows. The pursuit of knowledge is of course valued for its own sake, but knowledge can also be turned to account. Potential applications increase with the growth in knowledge, and with its wider availability (ie with its 'diffusion'). But in a competitive market individual actors seek to deny access to knowledge – so stymieing diffusion. They can achieve this in *practical* ways, mainly by hiding it, but this interferes with practical applications. IPRs offer a way out of this dilemma, by *prohibiting* some, but not all further uses of the information disclosed in the course of commercialising practical applications. Generally IPRs make a distinction between accessing and learning knowledge, which competitors can legitimately do, and putting such knowledge to certain directly competitive uses, which, for a limited term, is prohibited. This is often a difficult line to draw, and one that is much fought over in intellectual property law.

**[Secrecy]** In the absence of IPRs, there is a disincentive to invest in creating knowledge whose practical application results in disclosure. Even if knowledge can be kept secret *and* exploited (for instance a novel production process hidden in a factory), there still may be a disincentive to invest if there is a significant risk of independent invention by others. By contrast, in the absence of a significant risk of independent invention, if the innovator *can* exploit knowledge while retaining secrecy it is sensible to do so. But even though secrecy may be a practicable strategy for an individual actor, it is not necessarily beneficial to the innovation effort as a whole.

Secret knowledge is not diffused so others cannot benefit or learn from it. The cumulative and interconnected evolution of knowledge is disturbed by secrecy: knowledge generation does not occur in a vacuum but depends on access to other knowledge, as stepping stones, for serendipitous connection, for improvements, etc. Thus there is good reason to replace the vicious dynamic of secrecy with a benevolent dynamic of publicity, and IPRs attempt to achieve this in two ways: by linking exclusive rights to disclosure; and giving nuanced legal protection to trade secrets. In the patent system, legal restraints on imitation depend on an 'enabling disclosure', and the scope of a patentee's monopoly is strictly limited leaving many derivative uses free. And although the law does protect secrets, it does so only to a limited extent: whereas breaches of confidence are actionable, reverse engineering (eg taking apart a product) of secret information is not.

**[Diffusion of tacit knowledge]** In the presence of IPRs, knowledge is partly diffused by free transfer from public domain sources, and partly by proprietary exchanges, primarily on the basis of assignments and licences. Nonetheless some knowledge is not amenable to either method of diffusion, either because it is difficult to express precisely – is too costly to codify and record – or because it is too subtle to be transferred in a proprietary or 'dehumanised' form. Thus a lot of knowledge is instead diffused as tacit knowledge in the mind of people migrating between firms, countries, etc. Here also the law, through trade secrets and contract principles, plays a role by encouraging knowledgeable individuals to disclose and exploit their 'tacit' knowledge – thus aiding diffusion – but maintaining firms' rights over 'true' trade secrets. In particular, the law encourages individuals to share their knowledge with any firm they work for. It discourages broad claims by previous employers over knowledge that is not sufficiently itemised nor strictly a trade secret, and views with suspicion restraints of trade or non-competition clauses that limit the rights of employees to transfer to other firms with all their knowledge and experience.

**[The disclosure dilemma]** Publicity (for instance through a patent register) concerning the knowledge inventories of individual firms also benefits cooperation and coordination of research efforts. In an era where research is expensive and complex, and may bring together disparate areas of science or technology in highly complex systems, this is very significant. Secrecy, on the other hand, hampers coordination of research effort and results in unnecessary duplication. Unfortunately, publicising knowledge stocks presents something of a dilemma: it is often impossible to disclose knowledge without potentially destroying its commercial value. Thus it makes sense to encourage the sharing of knowledge by recognising and enforcing by law the conditions surrounding its disclosure imposed by the confidor. Thus the two legal mechanisms, the law of trade secrets which enables conditional disclosure, and the law of patents, which requires public disclosure in return for exclusive rights, encourage publicity and exchange of information about private knowledge inventories, and thus coordination and cooperation of innovation effort. This will also enhance the introduction of

complex products: knowledge of complementary technologies encourages complexity and sophistication.

**[The incentive to publish]** In other words, reliance on secrecy as a practical method of appropriating the advantages flowing from private investment in innovation has significant drawbacks: it skews private R&D investment towards technologies that can indeed be kept secret (eg process development rather than product development); and it encourages duplication and more generally reduces coordination of research strategies. Secretive innovators send no signals to competitors indicating research results obtained or directions under consideration. By contrast, publicity concerning knowledge inventories will limit duplication of research and enhance coordination between diverse actors interested in similar fields – so some incentive or legal guarantee attaching to disclosure may be beneficial, as addressed above. However, a key difficulty lies in the size and nature of the incentive to disclose hitherto secret knowledge. In the context of trade secrets law this incentive is infinitely variable, simply a matter for the parties to negotiate. But in relation to patent disclosures a universal standard must be devised. Various options are available: it may be advantageous to encourage disclosure *early* in the innovation cycle, when researchers first recognise *potential* practical uses of new knowledge, but specific technical applications have not been accurately described. However, then the scope of exclusive rights would be correspondingly broad; maybe *too* broad, as it may be beyond the capacity of the patentee to effectively coordinate the downstream development of multifarious applications and improvements. The patent may become a dead hand and chill independent development. If disclosure *later* in the innovation cycle (in relation to some concrete application of knowledge) is encouraged then the monopoly on offer as an incentive will be narrower and less of a potential obnoxious constraint on downstream development. However, duplication and lack of coordination of research effort will be more prevalent, since the signal to desist will only be received at a later date. Rent-dissipation theory attempts to reconcile all these factors. The law must devise a balance between the two, and patents law tends more towards the latter of the two options, by requiring detailed description of a concrete application with clear and present utility.

**[Public and private sectors]** As pointed out above, public funding and direction can compensate for the natural reluctance of private actors to invest in R&D in the absence of legal protection. But such funding has a significant role even where proprietary rights over knowledge do exist. Public funding makes sense where returns from research are too distant or uncertain to attract private investment (ie for 'blue-sky' or basic research). The short-term exigencies of business tend to discourage investment in highly speculative research, but nonetheless such research often turns out to be highly productive. Public funding also makes sense in areas of research with high need, but low returns: for instance, in relation to so-called 'orphan drugs' (rare diseases with high mortality rates). But at a more fundamental level, given its speculativeness, its intricacy, its multifaceted nature, and its widely dispersed knowledge base, scientific research must almost inevitably be conducted in the public sphere. The production and distribution of

science through research and education can realistically only be undertaken on a non-proprietary basis, ie organised around teaching, publication and peer review.

But where public and private spheres intersect, conflicts tend to develop requiring modulating rules. Various legal mechanisms come into play here. Firstly, there are those that set limits on appropriation, ie which delineate potential private rights and thus define the public domain. Secondly, there are those that formally regulate cooperation between public and private actors, and that regulate the transition of knowledge from the public to the private sphere. Contractual mechanisms such as joint ventures, spin-offs, CRCs, etc play a role in this area, but so also do the legal rules that determine conflicts over ownership of knowledge: between those who privately fund public research and the state; between researchers and institutions, etc. This area has evolved considerably in recent times, mainly because of increased integration and cooperation between public entities and private actors. New funding models for public institutions have encouraged appropriation at the institutional level, and in conjunction with commercial actors. The impetus for these changes has been partly fiscal, and partly policy driven: a perception exists that closer integration has better results in terms of commercialisation.

**[The law's considerable impact on the innovation matrix]** Depending on the priorities and value system of any given society a certain mix will develop between *a priori* bureaucratic decision-making and *ex post* market-based determination of new knowledge production. It is this 'matrix' that makes up the core of the innovation system. The law is one of the factors that influence the shape of the matrix, and that in many different ways. For instance, the exact scope of exclusive rights or the threshold requirements for their subsistence will co-determine the dividing line between public and private innovation resource allocation. The law also plays a crucial role in determining the balance between the secretive and the public stages of research and development, encouraging competitors to desist from duplicative research or seek a mutually satisfactory accommodation at certain junctures. The law will also be influential in determining the scale of the organisation of innovation. Anti-trust or competition law rules determine how far cooperation in R&D can go. Cooperation must be allowed to enable complex technologies to evolve and the stock of proprietary knowledge to be used efficiently; but on the other hand, research-based cartels must not result in counterproductive barriers to competition.

Whether innovation occurs inter- or intra-firm will also be determined in part by legal rules; in particular, those rules that determine the rights of employees over their knowledge and ideas, both in terms of ownership of what is legally construed as an individual invention, and in relation to trade secrets. These rules have an effect on the organisational scale and autonomy of innovation efforts: the spin-off, start-up, specialised R&D firm-model vs the integrated model of innovation, where firms are not specialised in innovation but integrate the whole process from conception through development to actual marketing. Furthermore, as diffusion of technology and of innovation is a good, it makes sense to encourage investment in development, refinement and market-responsive adaptation of

known technologies. The law will co-determine who undertakes these adaptations of technology to consumer demand: the original innovator or second comers. Thus the law will influence the innovation matrix in this sense as well.

**[Unfair competition torts as a regulatory tool]** If imitation is viewed as a form of competition which must be regulated in the public interest, then rather than develop a complex constellation of disparate legal responses, or proprietary rights, it may seem desirable to integrate the policing of imitation within the confines of a single legal standard of wide application, such as a tort of 'unfair competition'. Such a tort exists in one form or another in numerous jurisdictions, although not as such in Australian law. There is some conceptual difficulty with this approach if one accepts that imitation is not inherently unfair, but a normal and benign incident of competition. If such is the case, then when does imitation become so unfair that it should be restrained?

Despite greater flexibility, the inherent disadvantages of this kind of approach are twofold. The first is that it does not offer any great transactional advantages – in the absence of *a priori* established, delineated and recognised proprietary rights there is nothing around which to construct knowledge transactions with any certainty. The second is uncertainty resulting from its broad remit and vague standard ('unfairness'). Uncertainty in innovation decisions is exactly what the law might seek to *reduce*. In terms of innovation decisions, there is a definite advantage in clarity and certainty concerning what imitations or derivations will be allowed and what not. Furthermore, such an action also results in unpredictable and potentially major costs flowing from *ex post* resolution of conflicts concerning actionable vs permissible imitation. It may therefore be more attractive to adopt a system which will increase the *a priori* certainty as to what imitations will be allowed and what not, by creating clear and universal rules about object (the nature and scope of the innovation protected) and rights (what is an actionable innovation). But that will only be possible through some form of *a priori* and admittedly costly bureaucratic intervention. This leads us naturally in the direction of property rights as an alternative which may offer greater certainty and a universal transactional structure. Such a property approach lies at the other end of the legal spectrum from an unfair competition approach.

## Property theory

**[*A priori* determination]** The alternative to a broad action for unfair competition is a system of defined rights in knowledge 'units' itemised on the basis of predetermined parameters. This model has come to be known as a system of 'intellectual property' rights (IPRs). Many and varied parameters could be tested prior to grant; for instance, the level of investment in development of the new knowledge, the social utility of an invention, its moral value, the extent to which exclusive rights are necessary to prevent imitation, etc. But such investigations