Revisiting Intellectual Property Policy: Information Economics for the Information Age[1]

GILLIAN DEMPSEY

ABSTRACT *Many aspects of intellectual property policy are based on neo-classical economic assumptions about the nature of information and the process of innovation. In particular the argument for stronger protection is based on the assumption that markets are highly competitive and that information is non-excludable from free-riding imitators. This article challenges this traditional approach, arguing that information economics should be used to analyse problems of intellectual property policy. Recognition of a tacit–codified knowledge distinction, the embodiment of knowledge in information technology products, and the market effects of network externalities, will greatly assist policy-makers.*

Keywords: intellectual property, economics, network externalities, policy.

> [Incentive] analysis largely ignores the opposite perspective, that of the free flow of information. If we switch the perspective, we can see that one important purpose of [intellectual property] law is to make sure that future creators have available to them an adequate supply of raw materials. From this perspective, too many 'incentives' could convert the public domain into a fallow landscape of private plots.[2]

Economic activity is increasingly dominated by the production, distribution and consumption of information. A key issue in this age of rapidly expanding 'knowledge industries' and 'information economies'[3] is the encouragement of technological progress via the imposition of intellectual property rights.[4] Technological advances have consistently sparked calls for the expansion of existing intellectual property rights, or the creation of new rights. The rationale for granting intellectual property rights has historically rested largely on the economic argument that the offer of a 'limited monopoly' stimulates innovation, thereby promoting national economic advancement and consumer and social welfare.[5] Persuasive empirical evidence supporting such an argument is impossible to gather, so *a priori* reasoning prevails. Under neo-classical analysis, information is assumed to be perfectly appropriable. Without intellectual property, the output of innovation will be suboptimal and technological progress stunted. Such reasoning is often treated as sacred, inviolate, and the underlying assumptions seen as inherent truths. The question for intellectual property policy-makers is whether these assumptions about the process of innovation are appropriate.

This article argues that the neo-classical assumptions employed in determining intellectual property policy bias the debate for expansion or creation of rights in favour of regulatory intervention. This 'perfect appropriability' paradigm needs to be revisited

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from an information economics perspective, in which economic actors are imperfect due to varying technical proficiencies, as well as degrees of cognition, based on language, innate intellectual abilities and education. In this framework, information is a resource or input to the innovation process, and not a commodity or output from it. A distinction is drawn between knowledge in an abstract form, and the embodiment of knowledge within information technology products. Treating information as a resource recognises significant network externalities in the production of information technology.

Perfect Appropriability of Information

The pedigree of much of the neo-classical economic literature on intellectual property can be traced from Arrow's early paper[6] on the allocation of resources for invention, which argued that information, while valuable in conditions of uncertainty, was non-excludable and indivisible. Arrow argued that, within a context of market uncertainty, information itself 'becomes a commodity'[7] since it is valuable to economic agents in overcoming uncertainty. Information is, however, 'non-excludable', in the sense of being able to be reproduced with a trivial cost, and 'indivisible', in that the cost of producing information is unrelated to the extent of its use and value in the hands of others. Non-excludability is the origin of the frequently cited 'appropriability' problem, or 'public good' problem. The argument follows that, in the private market, there will be underproduction, relative to a 'socially optimal' quantity and quality of information-goods, unless there is some government intervention to create an incentive to invest. From this simple proposition comes the principal justification for intellectual property rights—the hypothesis that appropriability can be addressed by creating 'legally imposed property rights'.[8] Demsetz,[9] in commenting directly on Arrow's paper, argued:

> The degree to which knowledge is privately appropriable can be increased by raising the penalties for patent violations and by increasing resources for policing patent violations ... Given the appropriate legal apparatus and schedule of penalties it may be no more difficult to police property rights in many kinds of knowledge than it is to prevent the theft of automobiles and cash.

Demsetz's argument was central to much of the policy literature and political arguments surrounding intellectual property. Private property rights are believed to provide an incentive for the production of intellectual property because, if successfully marketed, there is a chance of obtaining a return in the form of income which creators can obtain through royalties and licensing. The role of intellectual property laws, therefore, can be seen as to ensure the appropriability of the value of the works when in the hands of users. Failure to provide for appropriability in this fashion leads to a less than socially optimal amount of investment in invention. Much subsequent literature from this tradition—particularly that originating from the Chicago school[10]—has accepted the 'reward for invention' argument as flowing naturally from Arrow's paper.

Arguments which base their assumptions upon the concept of information as a commodity have typically made an implicit assumption of a direct relationship between the scope of the property right, the returns to inventors and the level of investment in research and development. This direct relationship drives the conclusion that the objectives of intellectual property can be promoted by maximisation of potential returns to inventors. It follows that activities such as price discrimination through licensing between individual and 'site' software licences; hardback and paperback books; and individual and library subscription rates for journals, will serve to assure returns to investors by increasing the market power inherent in the property right. Such reasoning

leads to the conclusion that broadening the scope of monopoly rights granted by intellectual property laws is always desirable, as is imposing higher penalties for infringement, reinforcing government policing and the limitation or abolition of measures such as compulsory licensing and fair dealing.

Tacit and Codified Knowledge

A problem with the assumption of perfect appropriability is that it implies that information is costlessly communicated and reproduced. An information economics perspective suggests, however, that difficulties will arise both in transmitting and in receiving information. These difficulties can be illustrated by the conceptual distinction between 'tacit' and 'codified' knowledge. Human awareness follows a characteristic structure whereby particular aspects of consciousness are known subsidiarily and depend on a conscious focus. This subsidiary element is known as 'tacit knowledge'.[11] The personal nature of tacit knowledge gives rise to an important characteristic—it is not in a state that is readily communicable to others. To aid in its communication and to implement the knowledge in production, tacit information is codified. The process of turning tacit knowledge into codified knowledge (information) by giving it form is described as 'articulation'. Articulation is typically achieved through symbolic representations in language, mathematics, graphs and pictures. The manufacture of an information technology product, for example, relies on codified information such as formulae, laboratory procedures and blueprints. Codified knowledge is in a form that is intended to permit its communication. In a codified form knowledge is disembodied from individuals and can be described as 'information' rather than knowledge. Knowledge, therefore, is a 'matrix' of information that has been contextualised and digested either consciously or subconsciously.[12]

To illustrate, a bread recipe listing ingredients and approximate cooking times represents codified knowledge. Underlying this codified knowledge will be a body of tacit knowledge, which includes techniques of sifting, kneading, yeast preparation and judgement about precise cooking times based on appearance and other factors. The ability to transmit codified knowledge as information does not necessarily ensure understanding by the person to whom it is being transmitted. For example, possession of a recipe book does not imply mastery of the relevant skills to bake bread of high quality. To understand the recipe book, one would need in turn to understand the terminology, the use of kitchen appliances and in some cases the process of conversion between metric and imperial scales. As a preliminary factor the possessor of the book needs also to understand the language in which the book is expressed (another form of tacit knowledge).

This distinction between tacit and codified knowledge challenges the conventional assumptions of non-excludability, or 'public good' characteristics of information, in the sense of expensive production and inexpensive reproduction. Tacit knowledge is partly excludable since it requires a learning process on the part of the recipient, which can be costly and time consuming.[13] The more 'tacit' the knowledge, the more difficult it is to articulate and communicate. Public good arguments presume that knowledge is perfectly and costlessly communicable, yet particular skills are required to receive and make sense of information before it becomes knowledge. The ability to use a technology is only partly explained by the existence of codified sources. Practice, and feedback through criticism, are necessary for the learning and retention of many skills. Extending the cooking example, learning a baking process is significantly enhanced when a more experienced chef watches, explains, directs and corrects.

The tacit–codified distinction has implications for intellectual property policy. Intel-

lectual property only protects the embodiment of an idea or discovery, the 'manner of new manufacture' or the 'expression' of an idea. These embodiments of knowledge include information technology artefacts. A useful interpretation of an information technology artefact is that, while it represents an embodiment of knowledge, it does not necessarily constitute a codification of that knowledge. Possession of such an artefact does not necessarily reveal to the possessor the knowledge underlying its creation. Obtaining an understanding of this knowledge will involve a learning process, which will entail costs both financially and in terms of time taken in learning. This is an important point, since it implies that the artefact will not suffer from the same degree of appropriability and market failure (in the absence of intellectual property protection) which is assumed by neo-classical analysis. The conventional view assumes that technology is always highly codified and competitors or users can quickly and cheaply appropriate the knowledge underlying an information technology product.

Information as a Resource

One observation made by Arrow, and largely ignored by later neo-classical authors was that information is not only the *product* of innovative activity, it is also an *input* to innovation.[14] Under this view, information is a resource, since it is used to facilitate production, and indeed, invention.[15] Information as a resource is better suited than information as a commodity to an analysis of intellectual property regulation, as one of the policy objectives is to ensure that information is disseminated throughout society. Viewing information as a commodity causes the issue of dissemination of information to become secondary to a concept of information being traded. When viewed as a resource, the role of information in facilitating technological progress is a principal consideration. Information may be said to be *synthesised* and *innovated* rather than created, with innovators implicitly building on sources already in the public domain.[16] Technological progress, therefore, must necessarily build on a foundation provided by earlier inventors.[17] Ricketson[18] agreed that 'copying, reinterpretation and redefinition' of other works is integral to maintaining a healthy public domain.

Technological progress necessarily involves many participants and is evolutionary, social and interactive. Despite this, an important image within the neo-classical model is of innovation as a single, isolated process which takes place within the 'black box' of the firm, or more typically a starving author or inventor.[19] Conventional economists and policy commentators frequently (and somewhat pejoratively) describe competing firms as 'copying', 'imitating' or even 'stealing' an original innovation. Such a view necessarily results in policy whereby the first innovator should be rewarded while its competitors are punished for misappropriating the former's investment. The neo-classical view contrasts sharply with reality. Schumpeter[20] argued that an evolutionary process of technological advance involves a combination of innovation *and* imitation. Information economics perspectives conceive of innovations arising from information as growing synergistically in an environment of shared intellectual capital. Mandeville[21] rejects a model of one-way diffusion of information from an innovating firm to other firms:

> The conventional perspective basically seems to assume that technological information is completely embodied in the hardware that emerges from the self-contained, innovating firm. Users and adopters contribute nothing and thus are not innovating. The innovation process stops at the factory gate.

Indeed, neo-classical theory suggests that firms (including individuals) derive returns from proprietary knowledge, hence, they should have little incentive to share such

knowledge, particularly with competitors. Empirical evidence runs contrary to this assumption and shows that co-operation has been a beneficial strategy for the solution of problems and the development of new technologies. A major element of the incentive to co-operate within information transfer is the need to bring complementary knowledge to bear on the solution of common problems. Intellectual property policy, however, manifests a concern with restricting, privatising and trading information rather than sharing information. An expansion of intellectual property protection to achieve such a policy would impose significant retardation of information exchange with disastrous effects for innovation and competitiveness.

Network Externalities

Under an information economic perspective, the market can be characterised by assumptions of bounded rationality and interdependence among economic agents that support strong externalities.[22] These assumptions stand in strong contrast to those of neo-classical economics, which assumes perfect competition in the market: numerous buyers and sellers, homogeneous products, easy entry and perfect knowledge. The assumption of perfect competition has driven a pervading perception among policy makers that the market affords poor protection to innovators. An information economics perspective, however, provides a more realistic perspective: *homo economicus* is not endowed with perfect knowledge nor necessarily equipped with the means to receive information and correctly process and act upon it. Information is not a simple and objective concept (like a commodity) but adopts qualities contingent on *individual* and *organisational* capabilities (like a resource). Perceiving information in such a way causes a fundamental shift in assumptions as to the nature of innovation and the market.

One effect of bounded rationality is that standards arise where consensus defines a trajectory of technological development. 'Bandwagon effects', for example, are typical within a market affected by network externalities. 'Network externality' is a term that refers to the benefit that individuals get by accessing information held by other agents. An example of this is 'adoption externalities' where individual preferences are interrelated with what other people will want to buy. For example, as more people adopt the same word processing package, they enjoy greater interoperability and the task to transmit documents via computer becomes less difficult. The dynamics of adoption externalities affect the pricing and performance of new products, and have serious effects on the demand for information technology artefacts. Demand and diffusion effects of a new artefact are closely correlated as the benefit that a consumer derives from the use of a good. This is often an increasing function of the number of other consumers purchasing compatible items. Once it is accepted that innovation is a matter of gathering, assembling and transforming information into knowledge, network externalities can be seen as the source of enormous benefits, not only to consumers but also to producers in the form of providing significant market power by producers. This market power can be abused, however, resulting in anti-competitive behaviour through exploitation of the rights vested in the ownership of intellectual property. Although not technically monopolistic in many cases, this behaviour largely consists of a combination of cost raising strategies, switching costs, and product differentiation. Strategies designed to raise rivals' costs have a number of advantages in enhancing market power without infringing anti-trust laws. Examples of cost-raising strategies include: raising input prices; increasing expenditure on research and development; increasing advertising or promotional expenses; regulatory costs, such as intellectual property protection; and development of *de facto* or *de juré* standards.[23] A cost-raising strategy linked to product

differentiation is that of imposition of switching costs through risk-averse consumption. Simply put, this means that time and effort are consumed in learning how to use products. A consumer will usually demand that the features of any new product be similar to those features in which the consumer's learning effort has been expended (another adoption externality). For example, features dealing with the interface between the user and a computer program will be valued not only on actual and perceived need, but also on associated costs of obtaining the necessary knowledge to operate the program. These associated costs are known as switching costs. Switching costs place fringe firms and new entrants at a cost disadvantage, since to compete they would need to supply a perception of additional functionality or usability to overcome the heavy weight given by the users to interface factors. Switching costs are particularly effective barriers to entry where the extent of vertical integration is asymmetric to the rest of the industry. This means that established firms with little need to adapt technology from others have a clear cost-incentive to broaden the scope of protection. The implementation of standards, both *de facto* and *de juré*, therefore, are a key cost-raising strategy.

Allied to switching costs is the concept of product differentiation. One common method for product differentiation is to direct attention towards the features of the artefact. An equally powerful method is to cultivate a favourable brand image among customers and distributors. The resulting brand loyalty can create a dominant position by raising entry costs for rivals who will have to overcome such loyalty to compete. Brand loyalty may be increased through forward integration (such as buying into the distribution networks), post-sales service, and training of purchasing agents. Incentives actually exist against ensuring perfection in a product where imperfections allow for a demonstration of support services and a deepening of the personal relationship with the consumer—potentially increasing brand loyalty.

If a market is strong in externalities, an early innovator should have a considerable advantage in terms of market lead-time. A significant barrier to entry emanates from lead times in production and distribution. Based on these factors, a product will have a greater market lead time advantage the greater the degree of knowledge contained within that product and the greater the amount of knowledge required to make use of that product. For this reason, in many areas of intellectual endeavour, market lead-time advantage can be consciously exploited. Where the market is perceived to be threatened by some exacerbation of the appropriability problem—such as fears of widespread 'piracy' across the internet or the widespread adoption of the photocopier—there often follows a perceived need for broadening the scope of the property rights or otherwise strengthening the legal institutions. Policy makers instead need to be more aware of the effects of network externalities on the innovation process and possible concentrations of market power.

Conclusion

Information economics provides a distinct and preferable perspective to neo-classical economics in the analysis of technological development and therefore in the role of intellectual property in promoting innovation. The neo-classical approach, grounded in Arrow's concerns about appropriability, views legal intervention as necessary to correct a particular market failure: that innovators might be under-rewarded since the information they produced could be easily transmitted to those who were not compelled to pay for its use. Within this perspective, appropriability is achieved by the imposition of intellectual property rights, which generate an incentive to invest based on excluding access to information. This exclusion attempts to force information to mimic the

commodity characteristics of tangible goods. It follows that the promotion of innovation is found in the maximisation of potential returns to innovators and consequentially the perfection of appropriability through broadening of intellectual property protection.

In contrast to the commodity view, an information economics perspective views information as a resource. This conception of information considers information to be part of shared technological capital, rather than as an industrial product. Innovation itself is not a bounded, independent process involving a single firm and capital investments, but a process that is evolutionary and interactive, involving many participants. Cumulative innovation through imitation and learning is dictated by bounded rationality in the face of limited knowledge and abilities of the economic actors. The degree to which one can appropriate another's innovation is impeded both by the availability of the innovation in a codified form and the learning process involved in turning that codified knowledge into tacit knowledge. The less codified the knowledge, the less it displays public good characteristics.

Viewing information as dynamic and technological progress alters the perception of which factors will influence the market for information technology artefacts. Limited information processing abilities and costs involved in learning new information means that the market is likely to afford sufficient protection in the form of lead times and powerful network externalities such that investment in innovation can be rational without strong intellectual property protection. It is hoped that the infusion of an information economics approach might trigger the switch in perspective needed in the coming policy debates to ensure the integrity of the future intellectual commons.

Notes and References

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