

# **The economics of IP in the context of a shifting innovation paradigm**

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## **List of abbreviations**

BHTs	Bio-health technologies
FRAND	Fair, reasonable and non-discriminatory
ICL	Innovation collaboration
ICTs	Information and communication technologies
IIP	Innovation and intellectual property
IP	Intellectual property
IPR	Intellectual property right
M&As	Mergers and acquisitions
NGOs	Non-governmental organizations
NPE	Non-practicing entity
PPR	Physical property right
R&D	Research and development
SME	Small and medium-sized enterprise
TRIPs	Trade related intellectual property issues
WTO	World trade organization
US	United States of America

## **List of chapter contents**

- 1 Aims and limits
  - 2 Problem background
  - 3 Concepts
  - 4 Roles of IPRs
  - 5 Historical rationales of IPRs
  - 6 Economic and legal rationales of IPRs
  - 7 Role of IPRs in economics
  - 8 Policy alternatives to IPRs
  - 9 Shifting innovation and IPR roles
  - 10 Shifting views on the economics of IPRs
- Selected readings and literature references



## **1 Aims and limits**

The broad aim of this chapter is to describe the economic rationale behind IP rights and explore how the evolving nature of innovation has affected the way economists think – and perhaps should think – about the role of intellectual property (IP) and intellectual property rights (IPRs). The chapter is short, despite its broad aim, and details, technicalities and balanced comprehensiveness have to be sacrificed accordingly.

## **2 Problem background**

Innovations, being new and useful creations of all kinds, constitute the basis for cultural developments of all kinds in society – social, economic, technological, artistic, etc. At the same time any society with any type of economic system, be it market, planned, or mixed, has difficulties to make institutional arrangements for an adequate provision of innovations, without giving rise to a great deal of misfits, and unbalances. Society's codification of intellectual property rights of various kinds – patent rights, trade secret rights, copyrights, trademark rights, design rights, etc. – altogether constitute one of the oldest, if not the oldest, institutional arrangement for the provision of innovations. This arrangement evolved historically with numerous disconnected developments with origins in various places and periods, preceding the industrial revolution and many modern economic institutions like firms and R&D organizations. Thus the result was not a coherent IPR system built to last by a grand design. The IPR system has nevertheless stood the test of time over centuries, despite its fragmented and localized evolution, subjected to various new political orders, economic transitions, new radical technologies and new organizational modes of innovations. However, the long historic existence and proven adaptability of the various historically separated IPR institutions could not be taken as a guarantee

for their fitness in current times of major developments towards a global, capitalist, knowledge based economy with a surge of new technologies and a changing nature of innovation processes. These latter processes are becoming more varied in scale, complexity, dynamics and interdependence. In brief they are becoming more systemic, thus warranting the notion of ‘innovation systems’ of various kinds (global, national, sectorial, corporate etc.). Similarly, the IPR institutions, previously separated by type and nation, have become more integrated, complex and interdependent on a global scale which increasingly warrants talking about IPR system(s), at least then in a loose sense of the term system.

The general problem in this context is if the evolving IPR systems around the world, linked to various innovation systems, are still relatively fitted to these current developments or if not, how the IPR system as a whole could adapt, if at all. The IPR systems have become strengthened and expanded in the industrialized world since the 1980s, with various mainly policy-led origins in the US. A new, so called “pro-IP era”, then rapidly started to emerge and spread around the world as a consequence, rather than a cause, of the more slow and gradual development towards an economy dominated by knowledge and intellectual capital (hence the term ‘intellectual capitalism’). A long history of existence has certainly produced a number of misfits and controversies around IPRs. With the rapid emergence of the pro-IP era many old misfits and reasons for critique may thereby have become magnified, at the same time as new ones have emerged.

There is in addition to all this a particular feature of the general problem of designing and redesigning an overall IPR system, consisting of many IPR sub-systems, in a global innovation system. An IPR system essentially comprises a set of legal institutions for economic purposes, but it has historically (at least in the West) been mostly influenced by lawyers, and to some extent by engineers

and industry managers, and there has been little interest and involvement by economists, nor by politicians and the public at large, until recent years. This has contemporary led to stronger, newer and more broad-based critiques of the IPR system with accompanying controversies. At the same time economic research results for supporting policy changes are largely lacking, although growing as more economists enter the field.

Thinking and talking about rationales and roles of IPRs requires clarification of some key concepts, which are becoming increasingly common but still with less common meanings as the interest in the IP area has quickly grown in many communities worldwide in recent decades. Prevailing language differences, e.g. across IP specialists, IP creators, lawyers and economists in general, certainly sustain differences in thinking, especially regarding normative thinking. A brief exposé of some key concepts is thus called for.

### **3 Concepts**

Economics as a concept refers both to the subject of how to manage limited (but not necessarily fixed) resources, be they physical, financial or intellectual, and to the actual outcome of such management actions, typically analyzed in efficiency and value related terms (i.e. economic terms). Intellectual (intangible, immaterial) resources comprise knowledge elements (including data and information), embodied or not in artifacts or humans, and organizational relations (including reputation and trust). A limited resource as an object under the control (management) of an economic actor (subject) typically has a value to the actor and then constitute part of the actor's capital or assets, which also could be classified as physical, financial or intellectual. Capital assets could be measured in monetary or non-monetary ways. An item of intellectual capital or asset, e.g. an idea or a secret, could be "small" or simple but highly valuable and vice versa, i.e. "big" or complex but useless. Distinctions like these are

important to keep in mind when thinking and talking about size and growth of intellectual capital assets relative to other economic resources.

As any resource intellectual resources could (but not necessarily always should) be possessed, controlled and owned, and thus subjected to propertization by economic actors (agents). Intellectual property (IP) could in turn be associated with a legally codified right, IP right (IPR). Thus IP is a broader concept than IP rights (IPRs). There are different types of IPRs, related to different types of intellectual resources or objects, e.g. patent rights for mainly technological inventions, copyrights for artistic works, trademark rights for identifying symbols, trade secret rights for guarded, commercially valuable and not widely held secrets, database rights for databases, design rights for artistic designs, plus some other types of rights. As mentioned above these different types of IPRs have so different historic origins, rationales and roles that it is still difficult to envisage a consistent, let alone unified, IPR system of some sort worldwide, although there are moves in that direction.

Nevertheless, the different types of IPRs have some elements and features in common, like requiring elements of non-trivial creativity or inventiveness, novelty and usefulness, and having features like being temporary (with some exceptions), transferable and restricted in scope and jurisdiction. IPRs also have some elements in common with physical property rights (PPRs), e.g. exclusiveness, but there are also some fundamental differences, which limits the use of PPR notions in the IP area. Both PPRs and IPRs are fundamental for trade since with no property rights, there can be no trade. However, while the possession of a physical object can be transferred back and forth between agents when traded, an intellectual object like information can only be shared when traded and not be returned or dispossessed of. Moreover, it is impossible for a human to directly observe another human's possession of a secret. These two specific and fundamental features of IP in form of human embodied knowledge

– impossibility of dispossession and impossibility of observation of possession – actually calls for specific legal and economic arrangements or institutions for governing trade in IP or exchanges of IP more generally.

Although widely used, concepts as inventions (= novel ideas and creations), innovations (= inventions novel to all and useful to some), entrepreneurship (activities by an economic agent for launching innovations) and diffusion (series of adoptions of an innovation by economic agents) are fairly well and commonly understood. The defining characteristics of novelty and usefulness could then be qualified in different ways, e.g. novel to all in the world or in a country or in a company and more or less useful to many or a few.

Innovations are almost then by definition fundamental for various developments at large and thus come in many varieties in many contexts – technological, product/process, industrial, service, organizational, managerial, institutional, financial, cultural, etc. Many types of innovations could be propertized by one or more IPR types. (Innovations in form of novel and funny jokes seem to be somewhat of a rare exception.) Typically, however, each IPR type is tailored for certain innovation types. Patent rights, for instance, are possible to grant typically only to industrial or technological inventions that fulfill legally codified patentability criteria, like being novel to the world, non-trivial (non-obvious) and potentially useful to some extent. These patentability criteria are in principle similar across most countries in the world. They are also similar to some other criteria for granting (allocating) some other IPRs.

As seen from these definitions inventions and innovations are also fundamental for IP and the allocation of IPRs, since with no inventions there can be neither IPRs, nor innovations, and with no innovations there can be no useful (valuable) and thereby tradable IPRs.



## 4 Roles of IPRs

Inventions and innovations are necessary for granting (allocating) IPRs as seen from the above. However, this does not imply the reverse, that IPRs are necessary, let alone conducive, for the provision of inventions and innovations. In fact, based on historical analysis of periods in various countries with and without a patent system with and without significant rates of innovations and industrialization, evidence shows that patent rights have neither been necessary, nor sufficient, for technological innovations and economic developments. Similar evidence could be found for other types of IPRs (e.g. regarding the effects upon industry of database rights in Europe with no equivalent rights in US). However, conclusions like these are crude yes or no type of conclusions. Such binary conclusions do not say much about the role of IPRs on average or in special cases for increasing or decreasing the rate of innovations and their social and private economic returns. Here the evidence is much more scattered, roughly showing e.g. that patents have played a positive, complementary role in many cases and increasingly so over time and especially in recent decades, even if they have had a marginal role on average. Patents have e.g. been of significant importance in chemical and pharmaceutical industry, as well as of significant importance for the growth of many innovation based companies, also in other industries. At the same time the private values deriving from patents are extremely skewedly distributed with a few big hits and many almost useless and unused (uncommercialized) ones. There is in this context also a patenting paradox in the sense that despite the fact that patents on average have played a marginal role, companies make frequent use of the patent system. Moreover, the social value of patent information as opposed to patent rights, is most likely large but largely unknown so far. Also, the type of counterfactual and comparative analyses necessary to assess the comparative advantage of a patent system over other institutional arrangements with similar purpose and functions,

like tax credits, governmental contracts, grants and prizes have not so far been undertaken sufficiently enough for a comprehensive assessment of the historic and contemporary role of the patent system relative to its alternatives.

In summary, the important role of PPRs in general have been much more firmly evidenced by historical studies than the role of IPRs, for which there is a significant absence of evidence, as well as a significant absence of research. Absence of evidence of an important role for IPRs in innovation is not evidence of absence of an important role in contemporary economies, however.

## **5 Historical rationales of IPRs**

A fact that can not be dismissed in a description of the role of the IPR system is its long existence and almost undisrupted development in its fundamentals. Trade secrets and trademarks go back to the dawn of history all over the world. Patent like rights go back at least to the 14<sup>th</sup> century Europe and copyrights at least to the 17<sup>th</sup> century Europe. However, early patent-like rights were not typical property rights but rather privileges and concessions and later also exemptions from monopoly laws and regulations. The property right approach to patents is in fact comparatively recent, emerging in the 19<sup>th</sup> century. The utilitarian approach to IPRs, designed to serve a societal role rather than a role for individual private needs, had then become firmly established in the Western world.

The various IPR type components in the IPR system have then grown, internationalized and diversified, and steadily become more integrated and internationalized with different paces and extents for different IPR types. This multi-century long process has been robust against many political, technological and industrial revolutions. The patent system, for instance, has been adopted in its essentiality by almost all countries in the world, although with significant

variations in time and form. Legal changes in the patent system have trailed behind technological and economic changes (sometimes probably too much too often) but the system has all in all shown an undisputable adaptability and survival power. Other alternative institutional arrangements (tax credits, government contracts, grants and prizes), be they complements or substitutes for achieving similar objectives, do not by far have a comparable track record of sustained, widespread and internationally harmonized existence as the patent system. Thus there are likely some strong evolutionary rationales behind patent rights, as well as behind some other IPRs.

In searching for rationales for different IPRs it is instructive to look at how the corresponding rights notions have emerged and evolved. This issue has been studied for PPRs but not for IPRs by and large. In brief, PPR notions have evolved from establishment of first and sole (or prioritized and registered) possession (e.g. of fish and furs). However, such criteria are much more difficult, even impossible in principle, to use for intellectual resources. Secrets, as well as identity marks in general, have been used in proprietary ways since the dawn of human history and then with broader rationales than just to be functional for trade and exchange. Although neither secrets nor identity marks can be subjected to exclusive control, they are sufficiently associated with being possessed by specific individuals and organizations to be viewed as property rights. To the extent that exchange economies and trade evolved historically, secrets and marks became functional, justifying the notions of trade secret rights and trademark rights and the rights to recognition, authenticity and rewards or revenue shares from one's useful ideas and intellectual labor. These IPR types could then be seen as fundamental. However, neither first (prior) nor sole (exclusive) possession could be easily assured for identity marks (names, symbols) and neither is possible to assure for secrets, due to impossibility of observation and dispossession, without resorting to third parties for registration

and enforcement. With a few more steps of reasoning here one could then explain the emergence of institutional arrangements like what is today referred to as notarius publicus, registrators, courts and administrative offices for IPRs as responses to these impossibilities in order to facilitate and govern trade in intellectual resources, physically embodied or not.

Thus, the emergence of e.g. registration of patent like rights could be seen as emergence of an arrangement to establish first and sole possession of special types of information held as trade secrets, information useful not only for the possessor of the secret but to others in an exchange economy or in society at large. Similarly, IPRs such as design rights and copyrights could be seen as partly developing from especially trademark notions and efforts to take advantage of the functionality of property like rights. In this sense trade secrets and trademarks could be seen as fundamental and generic. Moreover, they are not cultural specific social constructs, but are more fundamentally related to the general nature of human needs, ideas and secrets.

In light of such origins and subsequent developments it is quite reasonable to rationalize the survival power of the IPR system as an institutional arrangement for fostering and governing innovation. Moreover, as a corollary it is quite reasonable to expect that the IPR system will continue to develop and is infeasible to abolish in its fundamentals.

## **6 Economic and legal rationales of IPRs**

As mentioned, the dominant rationales behind the IPR system are since long utilitarian from society's economic point of view, especially for the patent system and industrially related property rights. However, rationales still exist based on so called moral rights or natural rights or ideal rights, emphasizing the individual creator's rights to his/her (non-trivial) creations and recognition and

rewards associated with them. Starting with the patent system as a key subsystem in the overall IPR system, there have been various developments of economic rationales and theories over the centuries of its existence. Table 1 gives an overview of such rationales and theories. Incentivizing various activities in the interlinked innovation and diffusion processes has been the leading economic rationale for centuries. As such the patent system, as well as some other parts of the IPR system, could effectively be seen as a demand side oriented innovation policy although patent rights are exclusive rights to some inputs in the innovation process. Patent rights offer a competitive advantage to the innovator that translates into benefits to the innovator through sales of patents and patent based products, rather than through reducing costs of inputs into the innovation process. Such a demand oriented IPR approach could then be combined with supply oriented innovation policies, such as R&D tax credits (or deductions), grants, subsidies and other innovation financing measures.

However, there has in recent decades been an increasing emphasis on the role of patent rights and patent information as a governance mechanism in innovation, as shown in Table 1. This emerging governance view applies to other IPRs as well to varying extents. Then the IPR approach could be viewed more as a combination of demand and supply side innovation policy measures for governance purposes. A main basis for economic governance is the information the IPRs provide and the various decentralized decisions based on that information, e.g. patent information influencing technology management decisions in companies to eliminate duplicative R&D, to invent around, to find and perhaps enter into M&As or joint ventures, to license in and out, or to litigate or threat to do so. Trademarks signal quality and origin, influencing purchasing decisions, and artistic works protected by design rights and copyrights also signal information about originator and originality. The IPR system on the whole then provides a kind of contractual infrastructure in which

market signaling is essential for creating and enforcing contractual relations for trade and collaborative exchange. As contractual relations grow in number and complexity, and their economic implications increasingly become mediated by ICTs and intermediaries, more demands are put on a functioning contractual infrastructure, with more formalized, standardized and commonly understood contracting procedures. Implicit or informal contracting then create too much legal uncertainty and in addition recurrent contracting become too limited for enforcement. This is especially so if recurring encounters for exchange become less frequent due to increased mobility among a growing number of contracting parties.

Concomitant with the shifting view towards patents as a governance tool, there are shifting concerns, as seen from Table 1. These concerns largely address overall efficiency of a decentralized property approach to innovation. Some of these concerns will be dealt with below.

**Table 1 Economic rationales for a patent system**

<b>Received economic theories</b>	<b>Newer economic perspectives on patents</b>
<p><b>Incentive-to-Invent theory</b></p> <p>Focus: Impact on invention and R&amp;D</p> <p>Concerns: • Distortion of R&amp;D (e.g. too much substitutes/too little complements, too little basic/too much applied, too much patentable/too little unpatentable)</p> <ul style="list-style-type: none"> <li>• Barriers to competition</li> <li>• Heterogeneity of industries/firms/inventors</li> </ul>	<p><b>Patents as a joint incentive to innovate and diffuse</b></p> <p>Focus: Impact on dynamic competition through "continuous" and entangled (interdependent) innovation and diffusion processes</p> <p>Concerns:</p> <ul style="list-style-type: none"> <li>• As for incentive-to-innovate</li> <li>• Efficiency/distortion of diffusion</li> <li>• Interdependence of inventions and innovations over time (e.g. in sequential innovation)</li> <li>• Dynamic interaction between innovation and diffusion processes</li> </ul>
<p><b>Incentive-to-Disclose theory</b></p> <p>Focus: Impact on secrecy</p> <p>Concerns: • Quality/quantity of disclosure</p> <ul style="list-style-type: none"> <li>• Impact on R&amp;D (e.g. stimulation, coordination)</li> <li>• Impact on diffusion (e.g. on technology markets)</li> </ul>	<p><b>Patent rights and patent information as a governance mechanism</b></p> <p>Focus: Property rights allocation and disclosure as a mode of incentivizing and organizing for decentralized governance through management hierarchies and markets and hybrids of these two governance modes.</p>
<p><b>Incentive-to-Innovate theory</b></p> <p>Focus: Impact on innovation and competition</p> <p>Concerns: • Incentives ex ante and ex post invention</p> <ul style="list-style-type: none"> <li>• Impact on complementary investments</li> <li>• Transaction costs</li> <li>• Invention/innovation distinction</li> <li>• Patent scope and duration</li> </ul>	<p>Concerns:</p> <ul style="list-style-type: none"> <li>• Allocation and transfer of rights</li> <li>• Cumulation and dispersion of rights</li> <li>• Interdependence of rights</li> <li>• Scope and duration of rights</li> <li>• Enforcement of rights</li> <li>• Governance efficiencies, e.g. in terms of coordination and communication costs, e.g. market efficiencies, e.g. in terms of transaction costs</li> <li>• Optimal decentralized "tariffs" or "taxation" (through prices or damages)</li> <li>• Role of governance bodies and institutions (legislators, courts, patent offices, patent management, patent pools, clearing houses, anti-trust authorities etc.)</li> <li>• Alternative governance mechanisms</li> </ul>
<p><b>Prospect theory</b></p> <p>Focus: Resource exploitation efficiency</p> <p>Concerns: • Coordination and duplication of R&amp;D</p> <ul style="list-style-type: none"> <li>• Exploration</li> <li>• Improvement</li> <li>• Firm strategies</li> </ul>	

*Source:* Granstrand (2006)

## **7 Role of IPRs in economics**

As mentioned, patents and other IPRs have in the past up until the 1980s almost not at all been attended to by economists (not even by Schumpeter as an otherwise most important economist on innovations and entrepreneurship), with a few exceptions (like Plant, Machlup, Penrose, Arrow, Nordhaus, Scherer, Griliches and Mansfield). Nevertheless, silence on IPR issues have not prevailed but there has been a fair amount of long-running and recurring controversies, especially about patent rights (as reviewed by e.g. Andersen 2006). Proponents have argued that there is a need to attract and incentivize inventors and investors in innovation and that underinvestment in innovation otherwise would occur, and then an IPR approach is a good, if not the best, way to do so, compared to substitute alternative ways. National needs to support domestic industries have added strength to these arguments. Opponents have challenged these arguments and in addition pointed at a number of drawbacks or concerns such as (cf. Table 1): Especially risks for and losses from monopolistic behavior, over-pricing and under-provision of innovations in particular plus risks of distortion of R&D; high administrative costs; legal and economic uncertainty and costly strategic gaming, e.g. in patent races and patent based market powering by large companies and developed countries, to the point of the whole system being more or less subjected to various forms of abuses, including political capture by big industry in big countries. The standard defense against the argument that patents create monopolistic over-pricing and thereby distort static competition has been that patents are just promoting dynamic innovation based competition at the expense of static economic efficiency. This expense could on the other hand then actually be viewed as a way to finance innovation investments, a way that could be compared to a special type of privately administered selective consumption tax (Granstrand, 2006). This standard defense has in turn been countered by the argument that dispersion of many fragmented patent rights



creates not only a kind of anti-commons but a subsequent costly problem to assemble IPRs necessary for the provision of innovations. Thus, the IPR system, and the patent system in particular, would counteract its own purpose to promote innovation and dynamic economic efficiency and in addition simply become too unreliable and costly to run and use, and then also discriminate too much against weak actors. In other words, several more or less gradual changes have in response to the emergence of a more innovation-intensive economy led to too much of a good thing from the point of view of previous proponents, or too much of an already bad thing for previous opponents.

Along with various old and new views among old and new proponents and opponents there is, as mentioned, a growing interest in the IPR-system in economics, at least since the 1980s, due to the growth of IPRs and their economic significance. New entries into the field by academic economists are then often made with accompanying skeptical or critical views. These are partly based on traditional anti-monopoly attitudes, partly based on the insufficiency of research-based evidence to support the IPR system's many historically developed features and fixes, and partly based on observed mismatches between the functioning of a complex property rights approach and its purpose to promote complex innovation processes. The complexity and functioning of available alternative institutional arrangements and policy alternatives is then often not taken into account.

## **8 Policy alternatives to IPRs**

Table 2 gives an overview of common innovation policies, in the case of industrial R&D and innovation, as they mainly fall into the categories supply and demand side policies. (A distinction that is not so clear cut when viewed more closely, however.) Each policy has their benefits and drawbacks, of course, but systematic, empirical studies of their comparative advantages are

still largely lacking. In addition there have been rather few attempts to design and experiment with new types of innovation policies, especially on the demand side. Thus, it is indeed difficult at the present state of knowledge to separate and compare the relative costs and benefits of various innovation policies. A few principal comparisons could be made, however, as shown in Table 2.

**Table 2 Comparisons of R&D and innovation policies**

Policy	General characteristics	Suitable for	General experience
Patent-like IPRs	General, mainly demand side, policy	Decentralized governance and incentive for innovation and diffusion	Mixed across sectors and countries Internationally adopted and coordinated
Sales tax reductions or subsidies	Specific demand side policy	Targeted diffusion of selected innovations/technologies	Mixed Easy to administer
Innovation procurement contracts	Specific demand side policy	Ex ante financing of targeted risky innovations in weak or absent markets with decentralized supply	Often good Specific buyer competence needed
R&D/innovation tax credits/deductions	General supply side policy	Increasing R&D investments in profitable companies	Limited effectiveness Easy to administer
Innovation prizes	Specific supply side policy	Ex post financing of targeted innovations for decentralized supply	Often good Specific competence needed
R&D/innovation grants/subsidies	Specific supply side policy	Ex ante financing of generic, targeted innovations in weak or absent markets	Often good Specific competence needed

What briefly could be said in summary regarding these policies is that:

- There is no support for any single innovation policy to be a dominant superior substitute for others, neither on the supply, nor on the demand side.
- The heterogeneity, complexity and uncertainty of innovation processes in general call for using a diversified set of policies as complements.
- Especially combinations of supply and demand side policies are complementary and functional.

For further readings about policy alternatives to IPRs, see e.g. Wright (1984), David (1993), Granstrand (2003, 2011) and Scotchmer (2004).

## **9 Shifting innovation and IPR roles**

As described the IPR system has historically had a capability to at least partially adapt to changes in the nature of innovations. A valid question then is if the IPR system will continue to do so and more importantly how it should continue to do so. Various interdependent economic, legal and technological changes and trends worldwide then must be taken into account. These changes can not be reviewed in this chapter. (A review of them is given in Granstrand, 2003.) A few of these changes are radical but most are gradual, but their repercussions might not be, since large effects do not have to have large causes. As described above, the gradual emergence of a globalizing capitalist economy, dominated in some sense by intellectual capital (assets, property, resources) has led to the embedded relatively swift emergence of the globalizing pro-patent and pro-IP era since the 1980s, fostered e.g. by a trade related approach to intellectual property in the US and the TRIPs agreement in the mid-1990s and the creation of WTO.

Altogether these changes are sufficiently profound and wide-reaching to justify talking about a paradigm shift in the nature of innovation as well as in the nature

of IP and its governance through management, policies and other institutional arrangements in general.

In an attempt to summarize this new innovation paradigm one may say that intellectual resources and new technologies in particular have grown, internationalized, diversified and become more connected to large firms and in general become more interconnected and systemic and more valuable, propertized and traded on a variety of markets, including technology markets. These changes in turn have shifted emphasis from old to new roles of IPRs, from being mainly product market instruments for incentivizing innovation to becoming rights traded on markets for disembodied IPRs and used as assets (or asset bundles) unbundled from products in various forms of exchange. This separation or disembodiment of IPRs from physical product markets is not at all complete – as end user you can not feed on ideas alone. It is a matter of emergence of complementary markets in the form of more intellectual markets for trading IPRs, as well as more financial markets for financing innovations through use of IPRs as more tradable and more securitizable intellectual assets, bundled or not with other physical, financial or intellectual assets.

The increasing trade and tradability of IPRs then facilitate not only acquisition and exploitation of resources, e.g. of new technologies through various forms of technology trade, but also financing, even early stage financing, of investments in innovation. This is of course increasingly important when the scale, times and time pressures increases in innovation. The use of markets for IPRs, technology markets in particular, also facilitate open innovation, that is innovation activities coordinated across organizational boundaries of control and ownership. Open innovation, utilizing external and internal sources and uses of ideas and technologies, has a long history over centuries as a phenomenon. However, it has become increasingly frequent and important after Second World War. This is due to a number of factors, such as technological diversification (i.e. products

and companies becoming more multi-technology based), technological convergence, emergence of multi-purpose (generic, multi-product) technologies, and technological leveling across an increasing number of companies and countries. Altogether these changes in the nature of technological innovations increase the supply as well as demand of technologies on technology markets, thereby becoming thicker and more efficient. Technology managers and technology traders also learn over time, further making technology trade efficient. Technology trade efficiency, boosting specialization and division of labor in R&D and innovation, is further boosted by use of ICTs and use of IPRs and the contractual infrastructure IPRs provide through rights and market signaling. At the same time IP market design and efficiency is hampered by various factors, such as fragmentation and dispersion of rights, intellectual asset specificity and thin markets, opportunistic behavior and strategic gaming, and uncertainty (commercial, economic, technological and legal uncertainty), all factors that increase bargaining costs and transaction costs more generally, as well as risks of market failure and difficulties in design and promotion of new markets.

Use of ICTs and IPRs could boost efficiency in IP exchange more generally, e.g. in inter-organizational collaborations, e.g. involving a company's users, suppliers and other producers. The use of the term 'open' for characterizing collaborations and exchange in innovation processes is then deceptive, not mainly because it is a vague and frequently used term but because it is loaded with connotations of something being positive and free (in contrast to 'closed'), e.g. in conjunctions like 'open society', 'open science', 'open economy' and 'open access'. IPRs, restricting by definition access to an intellectual resource, are then thought of as something opposed to open or something reducing openness. However, IPRs could rather be seen as a means to induce creativity, openness, exchange and follow-up efforts in innovation by governing disclosure,

access and use of ideas and know-how. In the creation and innovation process, with perhaps 1% inspiration and 99% transpiration, fundamental things in human behavior apply, like need for recognition (c.f. trademarks and identity marks), achievement, reaping fruits of labor and the option to keep things secret. Thus, just as IPRs could be thought of as both anti- and pro-competitive, they could be thought of as both anti- and pro-open.

Balance in this governance is ambiguous and might be lost from time to time in various contexts, just as fairness in valuation, exchange and sharing is ambiguous and may be lost. However, the possibility of balancing or trading-off interests in collaborative innovation is there, although it could be argued that it is difficult or costly rather than impossible to achieve. On the other hand it could be argued that in the absence of IPRs open innovation, collaborations and exchange would be less effective and efficient.

Innovation collaborations (ICLs) constitute an area to which the IPR system has to further adapt and cater to. When looking back, the IPR system, and the patent system in particular, have evolved around incentivizing individuals, or small teams of them. However, the nature of R&D and innovation has become increasingly based on large interdisciplinary and inter-organizational teams (consortia, joint ventures, alliances, etc.), and at the same time more costly, longer, riskier, time pressured and difficult to manage. This is especially so in systems technologies (for energy, transportation, communication and health services) but also in entertainment and creative industries. One can expect this trend to continue, even to the point when global challenges (environmental, medical, military, political, etc.) call for technological solutions needing worldwide collaborations without being disciplined by market competition and trade.

A first natural question to ask about IPRs in the context of innovation collaborations (ICLs) is if they help or hinder ICLs. One has then to keep in mind two things. First that there is a large variety of ICLs, characterized by a large number of variables such as objectives, scale, length, risks, nature of parties and their relations, entry/exit rules, nature of background/foreground knowledge, disputes etc. Second that ICLs by themselves – with or without IPRs – are difficult to manage within as well as between organizations, be they firms, universities, institutes, government organizations, NGOs etc. Certainly IPRs tend to create an ICL atmosphere filled more with calculations, disputes and gaming than perhaps with inspiration, creation and generous idea exchange. Some kind of weak or flexible IPR regime may then benefit certain types of ICLs, e.g. ICLs between a large number of small non-competing parties, subjected as a group to external competition. On the other hand, a clear and strong IP regime might help an ICL with internal competition, like a small group of large companies developing an expensive systems technology standard competing with other standards, say in audio/video, computer or mobile communication technologies,. IPRs incur transaction costs, just as PPRs do, and sometimes they outweigh the benefits incurred by property rights and sometimes they do not. Moreover, actual transaction costs, e.g. in form of disputes, are more observable than inadequate incentives to join an ICL or to disclose an idea within an ICL, which in turn tend to bias perceptions against IPRs.

Transaction costs, including a.o. bargaining costs and various interaction costs more generally, are central to the efficiency of IPRs in ICLs. These costs can be lowered both by policy measures and management measures. A few examples of such measures can briefly be given here. However, more research on causes and consequences of transaction cost and IPR functionality in ICLs distributed across various organizational boundaries is definitely needed.

A number of possible policy measures to facilitate ICLs or joint ventures more generally are:

- International harmonization of IPR laws in joint ventures
- Facilitation of joint venture companies to apply for patents
- Less restrictions on patent pools/IP pools and cross-licensing arrangements
- More seasoned and economically justified use of compulsory licensing, licensing on FRAND terms and injunctions to prevent or deter hold-ups and abuse of bargaining power or market power
- Restriction of protection scope and patentable subject matter in areas prone to give high transaction costs, e.g. generic and/or highly interdependent knowledge/idea areas
- Exemptions tailored for highly interactive or remotely commercial ICLs of wide public interest.

In general IP policies ought to facilitate ICLs through providing a contractual infrastructure for managing ICLs rather than to attempt to tailor IPRs to the various types of ICLs. This point of view emphasizes the role of management and IP markets and also the role of new technologies in governing ICLs. The state-of-art in managing complex, distributed ICLs is yet not well developed but is improving, and likely then at a higher rate for IP managers than for IP policy makers. Individuals, companies, universities, institutes, government agencies etc. increasingly learn how to design IP regimes in ICLs, be they open source oriented, standard oriented, EU framework project oriented or international military alliance oriented. One should also note in passing that there is a certain,



albeit slow and partial, convergence of the traditional IP regimes in industry, university and public sectors.

A central part of the contractual infrastructure for distributed or interorganizational ICLs is licensing. There is a wide variety of licensing contracts and arrangements that provide building blocks for the design of a suitable IP regime for various ICLs, and new arrangements like copylefting and creative commons have emerged as need has arisen. What is not yet well understood is the generalizability and limitations of these new licensing arrangements in areas other than the original, e.g. in open source software development or in user-led innovation in general.

The variety of possible designs of IP regimes could finally be illustrated here by sketching the possibility to design a layer of privately managed IPR-like rights so to speak on top of the public IPR system as we know it. Ideas and other inputs into an ICL, small or large, patentable or not, could be registered, classified, tagged, protected, evaluated, disseminated, selected for commercialization, monetized, etc. by the collaborating parties themselves, providing their own privately run equivalents to invention registrar, and management bodies for dispute resolution and enforcement, etc. as complementary, not substitute, arrangements to public ones, like patent offices, courts, and other legislative, policy making and policing bodies.

Thus, in concluding, IP policies for ICLs can provide a contractual infrastructure for ICL management, upon which ICL management could design – or invent – their own ICL specific IP regimes. These could in turn actually turn out to be institutional innovations, diffusing across communities involved in ICLs. Incentives for developing and using such managerial innovations are already in place.

## 10 Shifting views on the economics of IPRs

*If one does not know whether a system ‘as a whole’ (in contrast to certain features of it) is good or bad, the safest policy conclusion is to ‘muddle through’ – either with it, if one has long lived with it, or without it, if one has lived without it. If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it. (Machlup, 1958, p. 80)*

As described the various traditional parts of the IPR system have a long existence, subjected to various critical and controversial views. The system and its parts seem strongly rooted and likely to be here to stay, more or less impossible to abolish wholesale. Thus, the various critical views have to be addressed by policy-makers. At the same time our growing knowledge about costs and benefits of IPRs to the global economy and society is still meager and fragmented for historical reasons.

Nevertheless, there are a contemporary economists advocating the abolishment of e.g. the patent system, or at least a radical reform of it, while others advocate more minor “fixes” or repairs. Classic critical views of the patent system claims that the system is (cf. Table 1):

- Creating overly costly monopolistic over-pricing and restricted access.
- A ‘one-size fits all’ type of system that is too crude and distortive.
- Creating high costs of patent granting and enforcement and substantial legal uncertainties.
- Leading to abuse by countries for national protectionist purposes.

- Lacking international harmonization.

Some critical views of the patent system have been amplified by various more recent changes in the nature of innovations and innovation processes, e.g. that the system is:

- Unable to adapt timely and properly to new technologies, like in software development and in biotechnology.
- Enabling large, resourceful companies to increase market and bargaining power and discriminate against SMEs, as more complementary resources are needed in the innovation process as well as in its embedded patent granting and enforcement process.
- Enabling large, resourceful countries to make a technological catch-up by developing countries more difficult and costly with the use of strong IP regimes with special designs.
- Allowing for costly gaming between actors, especially as they become more interdependent in their innovation processes.

Some other more recent critical views claim that:

- The patent system is enabling especially non-practicing entities (NPEs) to amass and exert excessively large bargaining power and pursue excessive rent-seeking activities. (Also referred to as patent trolls, patent sharks or patent extortionists.)
- The patent system and to some extent the copyright system counteracts its purpose by not only stifling static competition but also innovation-based dynamic competition through fragmentation and dispersion of IPRs, becoming more interdependent or connected, as do the underlying innovation processes.

- The objectives and functions of IPR systems could be better achieved by alternative economic mechanisms and policies.

Embedded in these more recent types of critique are also critical views of the way IPR laws and agencies are shaped and work, e.g. leading to:

- Too long times and large backlogs for processing patent applications.
- Too many bad quality patents, with e.g. too low inventive steps, creating high transaction costs.
- Too wide patent protective scope, especially in new technologies, creating too much blocking power.
- Misalignment of patent granting criteria and economic needs.
- Too costly enforcement through litigation.

Altogether these various and often valid critical views tend to sum up to a messy picture of an overly complex web of malfunctioning parts of an IPR system to the point of being beyond repair, or at least to the point of needing radical reform. Considering the currently fairly poor state of research based evidence it is then difficult in the short run to be constructive, although necessary in the long run as argued above.

What could presently be done, however, is to weigh and give priorities to various critiques and recommendations to policy makers and researchers and do so in the context of an emerging global innovation system rather than in a national context.

On top of the list of most important critical views of the IPR system, and the patent system in particular, one could then place the views (right or wrong) that:

1. The IPR system counteracts its own purpose, i.e. it stifles creations/inventions, innovations, and diffusion and malfunctions as a governance mechanism for both dynamic competition and collaboration.
2. The IPR system with its various advantages and disadvantages nevertheless is on balance inferior on average to alternative mechanisms for the provision and governance of innovations.
3. The IPR system is too fragmented into national jurisdictions, various IPR types and regimes, various granted IPRs and IP markets, etc., and lends itself too easily to strategic gaming and abuse, not only on company level but not the least on national level.

On a more operational level one should add the criticism that even if the IPR system has the potential to function well and has a *raison d'être* in principle, its parameters are not set right, thus giving rise to various misfits. Moreover that the processes by which the system is run are not efficient and the necessary accompanying technology and IP markets are difficult to design and prone to market failure.

There are of course a large number of more specific criticisms, illustrated above, but they are mostly possible to relate to this criticism of parameter setting and the operational design of the system. It goes without saying that the various criticisms also hang together, just as the various parts and features of the IPR system does. One can also note that some classic criticisms of the IPR system has lost some of its significance, not so much because the system has changed but because the views of the system has shifted, e.g. away from the view that the system is entirely anti-competitive due to monopolistic behavior. This does not mean that the classic criticism is invalid, far from it, e.g. in case of “evergreening” (i.e. prolongation of effective patent protection through various

means) or when restricted access to certain key medicines is creating socially unacceptable dead-weight losses.

One can also expect new phenomena to occur, giving rise to new important and valid criticisms, e.g. speculative IP trade and “IP-bubbles” on the IP markets. This is a quite likely scenario in a situation with increasing dominance of intellectual capital and intellectual capital flows on the world’s markets with high intellectual asset volatility and generally decreasing possibilities to diversify away unsystematic risks in increasingly interdependent asset markets.

So then – what to do about all this? The classic view of economist Fritz Machlup, cited above, is still valid, although it can be claimed that the IPR system should be kept not only because we yet know too little to justify abandoning it, but also because it is too deeply rooted in our human constitution and history. Thus, a major recommendation for policy makers and researchers is to search for repairs and fixes, not only restricted to the IPR system in itself but also directed towards its interplay and complementarities with other innovation policies and governance mechanisms. Also, as expected in the absence of sufficient evidence, innovation and IP-oriented research should in general be aligned with the major criticisms mentioned above, both theoretically and empirically.

The complexity and dynamics in and around the IPR system moreover calls for care in research design, interpretation and generalization, and drawing of policy conclusions, even in the presence of evidence. For example, there is both theoretical and empirical evidence that patents may give rise to hold-ups and IP assembly problems, and thereby stifle innovation, e.g. in case of sequential innovation with improvements being blocked by a patented invention upon which they build. However, despite a series of good and persuasive theoretical work that this may happen there is so far fairly little empirical evidence about a)

the extent to which this happens in different areas, b) the role of invent around possibilities to resolve a hold-up, c) the role of management “fixes” like licensing, pooling, or M&As, and d) the role of policy “fixes” like restricting the scope of the blocking patent or enforcing compulsory licensing.

Another example concerns some claims, based on a series of empirical studies of the importance companies attach to different means for appropriating benefits from their innovation investments. These appropriation means are based on patents, secrecy, market lead times or superiority in production and/or marketing. Most studies have then found that patents are not considered by respondents as important as certain other means. The conclusion sometimes drawn, based on this evidence, is that patents therefore are unnecessary. This is an incorrectly drawn conclusion based on such empirical studies, however. Complementarities among company strategies come into the picture, just as complementarities among country policies do. IPRs such as patent and secrecy in product as well as production technologies delay the competition and thus contributes positively to the innovator’s speed to market relative competitors, and thus to market lead time. It is true that in certain new business and technology areas, the product life cycle, cash flow profile and other innovation characteristics are such that the complementarity of a patent is weak. However, that is not sufficient evidence for removing the patent option, especially since these characteristics tend to change over time, possibly increasing the complementarity as companies and industries evolve.

Still another general recommendation for research in the innovation and IP area (IIP area) is to make empirical cross-national comparative studies of IP policies in the context of innovation policies, e.g. to do integrated IIP-policy research, thereby putting IP policy research more explicitly in an economic context. International comparative analysis is then especially called for in light of the widespread international adoption of IP policies and the IPR system, which is so

far more internationally adopted and coordinated than any other innovation policy. Many, if not most, developed and developing countries conduct policy research in the IP area but somewhat disconnected to innovation policy and economic policy research. Besides, there is a substantial generalizability of IIP policy recommendations across countries.

Finally, what policy recommendations apart from policy research recommendations could after all be forwarded? Some policy recommendations could be forwarded as policy experiments, although economic experiments are difficult and experiments with legal institutions perhaps even more so. Some could be forwarded based on available evidence, simple reasoning and proven experience, despite absence of solid evidence.

In fact many governments and organizations have in recent years been engaging in various IP policy reform works, mostly with a national orientation. Those policy recommendations cannot be reviewed here, but a few internationally oriented ones can be forwarded.

First of all, the IPR system in a globalizing, knowledge based economy has to be internationally harmonized and rationalized. While physical property rights more or less are tied to nation states, there is not such a thing as a sovereign state of ICTs or BHTs. Some available evidence then shows that harmonization should cater to the various development stages of different nations to allow them to catch up on reasonable conditions and be able to develop innovative and entrepreneurial capabilities for participation in international competition and trade. As to rationalization of the IPR system, there are vast opportunities for making recommendations, but one in particular could be forwarded here, and that is the rationalization and restructuring of governmental agencies and policy-making bodies. One could in this context make a plea for international interministerial policy councils for innovation and IP, connected to and at the



disposal of high political levels in international organizations, country group meeting and treaty works. One could also make a plea for more specialized IP courts and arbitration bodies with more institutional international collaboration, not only for more efficient but also for more innovative IP dispute resolution. Still another plea, which is also particularly illustrative of the potential for international rationalization of the IPR system, is to restructure the system of patent offices around the world, in large part applying similar criteria for patentability over and over again. Thus, there is a great deal of duplicative work done, using qualified resources that could far better be used for cutting the backlog of search and examination work. Increasing international collaboration and trade of services between patent offices, use of new technologies, use of new request and pricing schemes, use of international quality management techniques and use of a common global language (in parallel with a local language) for communication are all possibilities with a significant pay-off. Needless to say the obstacles to these recommendations, mainly political ones, are many and well-known but should not be abhorring in light of the possible pay-offs.

Second, it is of increasing and already large importance to have well-designed and well-functioning markets for technology trade and IP trade more generally, just as it is for other types of trade in products, services, stocks, etc. However, technology and IP markets and mechanisms for transfer and exchange more generally, are essential for the IPR system to work in innovation systems that become more complex and quasi-integrated with a mix of market and management oriented governance. Inter-governmental bodies and collaborative efforts for governing the workings of IP markets in conjunction with other markets are therefore needed. To some extent this could be achieved by building upon existing institutions, but more international coordination and regulation would be necessary. Various problems arising from hoarding of IPRs, trolling

by NPEs, strategic gaming in the shadow of expensive litigation, legal uncertainty, forum shopping, parallel imports and so on could be better addressed, if not solved, thereby. Policy tools like compulsory licensing, research exemptions, invalidation of any reverse engineering bans, provisional patent validation and clearance procedures, and transparency of IPR ownership could thereby be used in sensible ways.

Third and finally here, policies should also be directed towards supporting the development of IP management skills rather than to attempt to substitute for them through specific policies. IP awareness is needed in wide circles in society and IP management skills and advice are needed in industry at large, not the least regarding business and strategy and IP trade issues, and especially in less developed countries, industries and firms, SMEs in particular. It is of course true that many misfits and unbalances cannot be offset by superior IP management skills as a panacea, but it is equally true that many calls for policy intervention derive from IP mismanagement.

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